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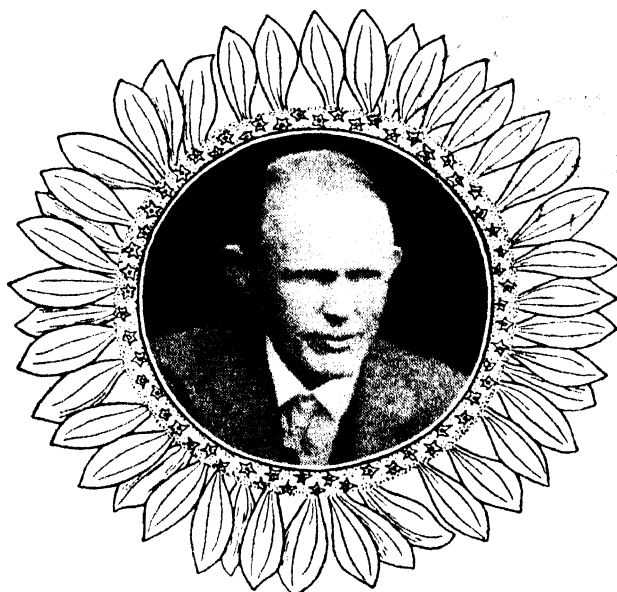
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SOME FLEAS COLLECTED FROM THE OKLAHOMA COTTONTAIL RABBIT, *SYLVILAGUS* *FLORIDANUS ALACER* (Bangs).¹

GAINES W. EDDY²

An attempt to obtain seasonal history data on the rabbit tick, *Haemaphysalis leporis-palustris*, was made by the writer during the year 1939. The data given below represent flea records from 176 of these animals.

The rabbits were all taken in Payne County. A few collected in January and February were live-trapped. The rest were shot, bagged in the field and taken to the laboratory for examination. A small handful of paradichlorobenzene crystals was placed in each bag. It was found that the fleas were more susceptible to "P.D.B." than were the ticks, and could thus be collected without too much tick mortality. It also appeared that the rabbit tick detached more readily in the presence of this chemical. In all cases the bags were placed in the center of a white cardboard, 4' x 4', under a strong light. However, if only fleas had been involved a better technique could have been employed.

Echidnophaga gallinacea (Westwood).

The sticktight or chicken flea is normally a poultry parasite. However, it shows very little host specificity. Its presence on rabbits is not uncommon.

Specimens were collected in February, October and December. Only six of the 176 animals examined harbored fleas. Of the 47 specimens collected, 42 were females. The range of most of the rabbits taken did not bring them in contact with domestic animals. This probably accounts for so few of the cottontails being parasitized.

Recent findings have increased the medical importance of this flea. Brigham (1941) isolated two strains of endemic typhus from naturally infected specimens in Georgia and plague infested fleas were taken in California by Wheeler (1941).

Hoplopsyllus affinis (Baker).

This flea is mainly a parasite of rabbits and hares, but is often found on their predators. More than 90 per cent of the 3,330 speci-

¹A contribution from the Oklahoma Agricultural and Mechanical College, Department of Entomology, Stillwater.

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mens collected were of this species. Better than 65 per cent were females. Both sexes were active throughout the year. The flea increased from an average of 6.8 in January to 38.6 in June. It dropped to 6.3 in August, but had increased to 50.6 in November. An increase or decrease in one sex was associated with a similar cycle in the other. It is not known how many generations this species normally completes in a year, but two are indicated by the above figures. However, the locality, season of the year and number of animals examined have a direct or indirect influence on the average number of fleas collected.

Cediopsylla simplex (Baker).

This flea represents another common rabbit parasite. However, it is known to attack a large number of animals. Although common, the flea was found not to be prevalent. More than 50 per cent of the animals examined were negative. A total of 194 specimens were collected and the males slightly outnumbered the females. A few specimens were taken in all months except September, October and November. In no month did the average number of fleas per rabbit exceed 3.3 per cent. This flea is probably active throughout the year. Jack rabbits taken in the same areas were more heavily infested than were the cottontails. Those records are not included here.

The average number of fleas, *H. affinis* and *C. simplex*, collected from the cottontail rabbit is given in the table below. Similar data for the other species were incomplete.

Pulex irritans Linnaeus.

The human flea is not an uncommon parasite on rabbits. The six specimens collected were removed from three animals. One male and four females were taken in October and one female was found in December. Several fleas were collected in the same areas from jack rabbits and from the spotted and striped skunk. This flea appears fairly well distributed over the state. Specimens from widely separated localities have been taken by the writer.

Ctenocephalides felis (Bouche).

Apparently wild rabbits are not heavily infested by cat fleas. Only two females were taken and these are represented in collections made in May and December. It is scattered throughout the state.

Orchopeas leucopus (Baker).

This flea is normally a parasite of mice. One female was removed from a rabbit in December.

Orchopeas sp.

A single badly mutilated female specimen was collected in Febru-

ary. It is probably *sexdentatus*.

The average number of fleas, *Hoplopsyllus affinis* and *Cediopsylla simplex*, collected from the cottontail rabbit, 1939-1940.

Date	No. Rabbits Examined	<i>H. affinis</i>			<i>C. simplex</i>			Ave. for 2 species
		Males	Females	Total Ave.	Males	Females	Total Ave.	
January	25	2.8	4.0	6.8	.28	.28	.56	7.4
February	12	2.6	6.6	9.3	.50	.41	.91	10.2
March	6	4.1	6.2	10.6	1.16	2.16	3.33	14.0
April	40	2.4	4.1	6.6	1.27	1.05	2.32	8.9
May	23	6.5	11.9	18.4	.91	.43	1.34	19.8
June	11	16.2	22.3	38.6	.27	.45	.72	39.3
July	22	8.3	11.8	20.1	.13	.31	.45	20.6
August	3	2.6	3.6	6.3	.33	.66	1.00	7.3
September	7	3.2	5.4	8.7	—	—	—	8.7
October	7	11.4	17.8	29.2	—	—	—	29.2
November	8	20.1	30.5	50.6	—	—	—	50.6
December	12	16.1	24.0	40.2	—	.33	.33	40.5

Summary

An attempt to obtain seasonal history data on the rabbit tick, *Haemaphysalis leporis-palustris*, was made during the year 1939. This paper represents flea records from 176 of these rabbits.

A total of 3,330 specimens, representing six species (probably seven) was collected. The species and the number collected are as follows: *Echidnophaga gallinacea*, 47; *Hoplopsyllus affinis*, 3,080; *Cediopsylla simplex*, 194; *Pulex irritans*, 6; *Ctenocephalides felis*, 2; *Orchopeas leucopus*, 1; and *O. sp.* (probably *sexdentatus*), 1.

A table showing the average number of fleas, *H. affinis* and *C. simplex*, collected from the cottontail rabbit during the year 1939, is given. *H. affinis* was collected in every month, but *C. simplex* was not taken during September, October or November.

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DIPTERA ASSOCIATED WITH IRONWEED, *VERNONIA INTERIOR* SMALL IN KANSAS.*

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A study of the insects associated with the ironweed plant *Vernonia interior* Small has been carried on as a part of an investigation on the grassland insects of eastern Kansas. Two reports have previously been prepared on ironweed insects; one dealing with 47 species of Coleoptera (Schwitzgebel and Wilbur, 1942); the second dealing with 10 species of Lepidoptera, 25 species of Hemiptera and 22 species of Homoptera (Schwitzgebel and Wilbur, 45: 195-202, 1942, Kans. Acad. Sci. Trans.). The present discussion concerns 10 species of Diptera which are known to live on *V. interior* and 34 species which were collected on this important weed but whose relationship to the plant has not been determined.

The areas under observation include pastures with an abundance of ironweed in Riley County near Manhattan, in Pottawatomie County on the Blue River north of Manhattan and in Doniphan County near Wathena.

For rearing trypetids and their parasites, ironweed flowers were collected in the field and placed in cardboard cylinders, each fitted with a glass vial on one side near the middle. As the flies or parasites emerged, they moved to the vials, which provided the only source of light, and were collected. Ironweed galls were likewise placed in this type of rearing cage, but only parasites of the gall midges emerged. Since the dried ironweed stems were quite hard in the spring, it was difficult for the gall midges to emerge until the galls had been softened. This was accomplished by placing gall-infested stems in a lamp chimney which was covered at both ends by netting. The chimney with galls was set in a flower pot containing sand which was kept saturated with water. A large series of midges and their parasites were reared by this method.

TRYPETIDAE

Five species of Trypetidae were reared from ironweed flowers in eastern Kansas. In the vicinity of Manhattan *Neaspilota alba* Loew and *Tomoplagia obliqua* Say were reared and two other species, *Neaspilota vernoniae* Loew and *Trupanea acutangula* Thom. were collected. In Doniphan County S. C. Schell reared five species: *N. alba*, *N. vernoniae*, *N. albidipennis* Loew, *T. obliqua* and *Trupanea* sp.

*Contribution No. 514 from the Department of Entomology. This investigation was conducted in part in connection with project 211, Bankhead-Jones.

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Species *alba*, *obliqua*, *albidipennis*, and *vernoniae* were taken from ironweed in Pennsylvania by Osten Sacken and reported by Loew (1862) under the genus *Trypetae*.

In Kansas both *alba* and *obliqua* were reared from the seeds. The larvae of the first generation began feeding on the ovules about the time the flower buds opened and the full grown larvae of the second generation were feeding on the seeds in other involucre late in the summer. In most cases the feeding activity of the larvae was responsible for the destruction of the seeds in each involucre infested (Fig. 6).

In late summer the infested involucre could be detected by the presence of dry brown flowers which still clung to the wings of the partially devoured seeds. Normally in early autumn the involucre opened and the seeds were released but with the infested flowers this opening failed to occur. Although this unusual procedure was of no consequence to the plant since most of the seeds in the involucre had been destroyed, it was important to the insects. They utilized the protection thus offered and overwintered within the involucre as full grown larvae.

A determination of the abundance of these trypetids was made by examining 59 stems selected at random from three different pastures. Each stalk had from 26 to 600 flowers, averaging 130 flowers. Twenty-five percent of the flowers were infested by trypetid larvae. The higher the flower was located on the plant the more liable it was to infestation. Up to 65 percent of the flowers on some stems were infested although only a single larva was found in any one flower. *Neaspilota alba* and *T. obliqua* were the most abundant species and only a few of each of the other species were taken. *Neaspilota alba* was about eight times more abundant than *T. obliqua*.

Relative abundance of Trypetidae on ironweed in two localities in eastern Kansas:

Species	Number of specimens				
	Riley County			Doniphan County	
	Reared	Collected	Total	Reared	Total
<i>N. alba</i>	27	383	410	43	43
<i>T. obliqua</i>	50	46	96	74	74
<i>N. vernoniae</i>		2	2	6	6
<i>T. acutangula</i>		1	1		
<i>N. albidipennis</i>				1	1
<i>Trupanea</i> sp.				1	1

Neaspilota alba Loew. The egg was 0.72 mm. long and 0.19 mm. in diameter. It was white, slightly curved, and pointed at one end. The dingy white larva varied in length from 2 to 3 mm. at maturity. The pupa was slightly smaller than the mature larva and similarly colored. The adult was whitish with whitish wings without markings (Fig. 4). The abdomen was yellowish, length of body about 3.5 for the female; male, slightly shorter (Loew, 1862).

Life history. This species passed through two generations each year. The full grown larvae of the second generation overwintered in the involucre. The adults emerged during the latter part of May and June. Oviposition occurred during June and July upon the opening of the involucre exposing the purple-tipped corollas. The female alighted atop the flower, thrust her ovipositer down inside the flower, and left an egg lying against the inside of the involucre. The maggots fed upon the developing seeds for two to three weeks before pupating. The first generation required about a month to complete its life cycle.

Adults of the second generation sought fresh flowers on which to oviposit. The majority of the second generation larvae were still feeding during late September and went into the winter as full grown individuals. Compared with the first generation, the overwintering insects were few in number as a result of the high degree of parasitism.

Tomoplagia obliqua Say. No eggs were found on the plant but those dissected from the female were similar to the eggs of *N. alba*. The larva was about the same size and color as *alba* except for the last few abdominal segments of *obliqua* which formed a distinct black plate (Figs. 7 and 8). The pupa was dingy white and slightly smaller than the mature larva. The adult had a brownish-yellow body, with two series of black spots on the abdomen. Its wings were yellowish with brownish oblique bands (Fig. 5). The body and wings were each about 3.5 mm. in length (Loew, 1862).

Life history. Only brief data were obtained concerning the life cycle of this species. It was thought that oviposition took place after the middle of July since the first adults were taken on July 14. The larvae developed until mid-August when the adults began to appear. Larvae were found in the flowers as late as the middle of September and it is supposed they overwintered as full grown individuals. Adults were reared continuously from August 19 to September 27.

Neaspilota vernoniae Loew. This brownish-colored fly was slightly heavier than either *alba* or *obliqua*, with brownish marks on the wings (Loew, 1862). No data concerning the life history of this species were secured but the fact that two adults were collected during July from ironweed and that six adults were reared in August

suggested that the life cycle of this species was quite similar to both *N. alba* and *T. obliqua*.

Neaspilota albidipennis Loew. The adult was similar in size and color to *N. alba* except for its blackish stigma. Schell reared one specimen from ironweed in Doniphan County, August, 1939. None was found on ironweed near Manhattan.

Trupanea sp. One specimen was reared by Schell in Doniphan County during August.

Trupanea acutangula Thom. One adult was swept from ironweed in Pottawatomie County, May 28.

Parasitism of the trypetids. More than 1200 hymenopterous parasites comprising ten families and 22 species, three of which were new, were reared from these trypetids. Whether or not all of these species were primary parasites was not ascertained.

No determination of the extent of parasitism was made except by comparing the number of flies and parasites which emerged from the same rearing cages. Since only 77 flies of the first generation were reared as compared with 710 parasites, each from a single fly, there appeared to be approximately 90 percent parasitism.

Even though such a high degree of parasitism existed, the maggots were still able to bring about a 25 percent reduction of the seed crop. This fact gives some indication of the effect the trypetids might have on the ironweed plant if the parasites did not tend to hold them in check.

This list of parasites of the trypetid seed maggots is as follows:
Braconidae

Apanteles lunatus (Pack.)

A. epinotiae Vier.

Heterospilus languriae (Ashm.)

Microbracon nuperus (Cress.)

Rhaconotus n. sp.

Chalcididae

Brachymeria fonscolombei (Dufour)

Cynipidae

Melanips iowensis Ashm.

Elasmidae

Elasmus setosiscutellatus Cwfd.

Eulophidae

Elachertus sp.

Tetrastichus sp.

Eupelmidae

Eupelmus sp.

Eupelmus allynii (French)

Eurytomidae

Eurytoma n. sp.*Eurytoma* n. sp.*Eurytoma* sp.

Mymaridae

Gonatocerus sp.*Polynema caesariatipenne* Gir.*P. bifasciatipenne varium* Gir.

Pteromalidae

Catolaccus kansensis Gir.*Habrocytus purpureiventris* (Ashm)

Chalcidoidea

Amblymerus sp.*Zaglyptonotus schwarzi* Cwfd.

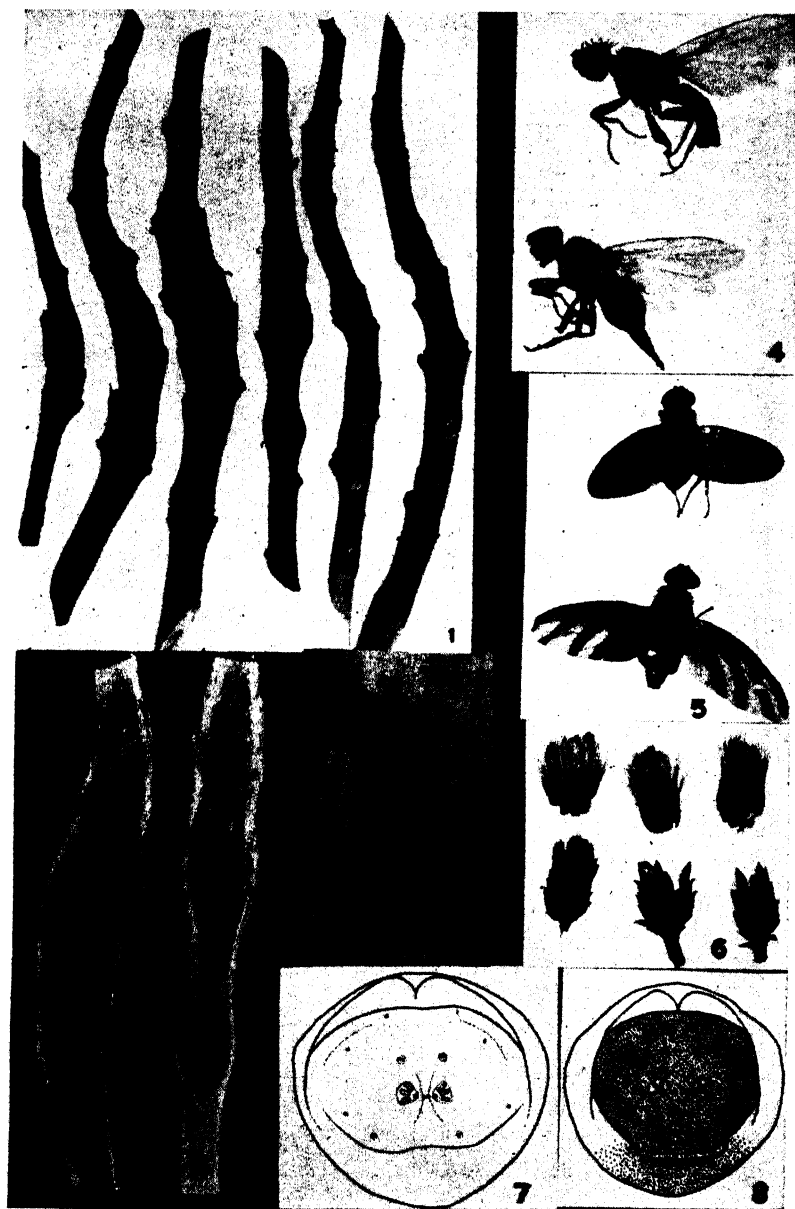
Most of the parasites emerged at the time the first generation adults were present. A total of 42 specimens were reared in May, and ten were collected during June and July. Three species, *Tetrastichus* sp., *Eurytoma* n. sp. and *Eupelmus allynii* were also reared from the cecidomyiid stem galls. *E. allynii* is a well known parasite of the Hessian fly, the joint worms and other crop pests.

Eutreta sparsa Wied. This gall-forming fly was not taken during this study but was reported by Painter (1935) on ironweed in Texas as follows:

Hosts: *Ratibida columnaries* D. Don. (cone flower) and *Vernonia interior* Small. The gall occurs on the stems of both hosts and in *Vernonia* is an oval swelling 6x10 mm. in size often tinted with purple. The galls are present from early April through May. Adults from both hosts emerged in cages, April 20 to May 30. It appears probable that the insects overwinters in the gall in the crown of the plant. Galls were more abundant on *Ratibida* than on the other host.

EXPLANATION OF PLATE

- Fig. 1. Galls caused by the midge *Lasioptera vernoniae* Beutm. in ironweed stems.
 Fig. 2. Longitudinal section of ironweed stems showing closely compacted galls of the midge *L. vernoniae*.
 Fig. 3. Longitudinal section of gall of the midge *L. vernoniae* showing larva within the gall.
 Fig. 4. *Neaspilota alba* Loew, male above, female below.
 Fig. 5. *Tomoplagia obliqua* Say, male above, female below.
 Fig. 6. Trypetid injury to seeds of ironweed plant. Left involucre shows emergence hole and center involucre has a puparium. The seeds (above) from these involucres are completely destroyed. Involucre and seeds at right are uninfested.
 Fig. 7. Caudal aspect of *Neaspilota alba* Loew larva.
 Fig. 8. Caudal aspect of *Tomoplagia obliqua* Say larva.



CECIDOMYIIDAE

Only one species of Cecidomyiidae was observed during this study, *Lasioptera vernoniae* Beutm., the larvae of which cause galls along the stems. Two other species have been reported from ironweed.

Lasioptera vernoniae Beutm. No eggs were found. The larva was yellow, about 2.5 mm. long and 0.5 mm. in diameter. The adult was gray with a yellowish-brown abdomen, the male 1.5 mm. long and the female slightly larger.

Injury to the plant. Oviposition probably occurred during May or early June since adults emerged from the stems in April and May and the galls were well formed by June and July. When the larvae entered the pithy portion of the stem, a gall was formed about them. Sometimes single cells were distributed along the stem (Fig. 3) but often a large number of galls (Figs 1 and 2) developed within a small space. This caused a noticeable enlargement of the stem, often so great that splitting of the stem occurred.

Even when splitting did not occur, the galls frequently caused the stem to become brittle and the passage of nutrient materials through the stem was probably interrupted. The only evidence to substantiate this was the fact that only a few flowers developed on many of the stems which were deformed by large numbers of galls. Galls were also found on the petioles.

Painter (1935) reported the following concerning galls caused by this midge on *V. interior* in Texas:

The galls vary greatly in shape and occur on the stem, midrib, petiole, and the receptacle of the flower. They are polythalmous, cylindrical, the larvae feeding in the pith. Some galls are usually 30x10 mm.; the midrib swellings 25x5.

Abundance. During the summer of 1940 examinations were made of 128 stems. Seventy stems or 57 percent had galls caused by *L. vernoniae*. There was a total of 793 galls in the 73 stems or an average of 11 galls per stem. The number of cells in a single stem varied from 1 to 54.

Life history. The full grown larvae pass the winter inside the galls in the stem. Adults emerge in April and May as soon as weather conditions are favorable. In the laboratory one of the most important factors for their emergence was moisture. The outer tissues of the stem dried to form a hard covering and until this was softened it was impossible for the midges to escape. Oviposition occurred in May and the maggots entered the stem to feed in late May and throughout June. By mid-July the larvae began to assume their yellow or orange color and apparently had reached their maximum growth.

Parasitism. Two hundred and forty-seven hymenopterous parasites comprising eleven species, five of which were new, were reared from the galls:

Braconidae	Eupelmidae
New genus and n. sp.	Eupelmus allynii (French)
Ipbiaulax sp.	Eurytomidae
Trichacis rubicola Ashm.	Eurytoma n. sp.
Trichacis rubicola var.	Eurytoma n. sp.
Platygasteridae	Eulophidae
Platygaster sp.	Tetrastichus sp.
Callimomidae	
Callimome n. sp.	
Callimome n. sp.	

Only 95 specimens were reared from the galls during July and August. The others emerged in April and May simultaneously with the emergence of the midges.

No determination of the extent of parasitism was made. However, during April and May approximately the same number of parasites emerged as did midges. Since other parasites emerged during the growing season of the previous year, the percentage of parasitism was greater than 50 percent.

Youngomyia vernoniae Felt. This midge was not collected during this study nor were any galls which might have been caused by this insect observed on the plant. The species was described by Felt (1911) and was reared from blossoms of *V. noveboracensis* in Virginia.

Asphondylia vernoniae Felt. This midge was reported by Felt (1918) as having been reared from buds of ironweed. None of this species was collected during this investigation.

AGROMYZIDAE

Larvae identified as **Agromyza** sp. burrowed in ironweed stems. No adults were reared and consequently the species was not determined. The larvae were whitish, slightly curved, about 6 mm. long and 0.8 mm. in diameter with two black hooks on the end of the abdomen. The puparium was light brown in color, 4 mm. long and 1 mm. wide.

The feeding of this borer resulted in a rather straight burrow down through the center of the pith. The burrows usually started about half-way up the plant and terminated at the crown, varying from 12 to 24 inches in length. The maximum width of the burrow was 3 mm. These insects fed during 20 to 30 days but caused little injury.

Approximately 12 percent of the 128 stems examined were infested with **Agromyza** larvae, usually at the rate of one larva in a stem.

There was one generation each year. The mature larvae overwintered in their puparia which were formed during mid-July. No eggs were found but young larvae were taken the first week in June which suggests that emergence of the adults and oviposition probably occurred in May.

Three species of *Agromyza* adults were collected from *V. interior* in May but whether or not any of these insects were the same species as the borer concerned was not learned.

DIPTERA COLLECTED FROM IRONWEED IN THE FIELD

The following Diptera were collected from ironweed plants from May through September. Certain of these species are predators, others were attracted by the blossoms while the remainder were undoubtedly utilizing the foliage for shelter.

A List of Diptera Collected From *V. interior*

Family	Species	Collection Period	Total Specimens
Chironomidae			
	<i>Anatopynia</i> sp.	May	3
Bombyliidae			
	<i>Systoechus vulgaris</i> Lw.	Aug.	9
Therevidae			
	<i>Psilocephala haemorrhoidalis</i> (Macq).	July	1
Empididae			
	<i>Platypalpus</i> sp.	May	20
Dolichopodidae			
	<i>Gymnopternus</i> sp.	Aug.	2
	<i>Psilopus silpho</i> (Say)	July	2
Asilidae			
	<i>Asilus mesae</i> Tucker	July	1
Helomyzidae			
	<i>Leria</i> sp.	May	1
Borboridae			
	<i>Sphaerocera</i> sp.	May	1
Sapromyzidae			
	<i>Camptoprosopella</i> sp.	May	3
	<i>Sapromyza</i> sp.	Sept.	1
Trypetidae			
	<i>Carphotricha culta</i> Wied.	July	4
Sepsidae			
	<i>Sepsidimorpha secunda</i> Mell.	May	1
Ephydridae		May	1
Chloropidae			
	<i>Anthracophaga declinata</i> Beck	May	3
	<i>Chlorops 5-punctata</i> Lw.	May, Sept.	50
	<i>Chloropisca glabra</i> (Mq.)	May	1
	<i>Gaurax</i> sp.	May	1
	<i>Madiza</i> sp.	Aug.	1
	<i>M. cinerae</i> (Lw.)	May	1

Family	Species	Collection Period	Total Specimens
	<i>Meromyza americana</i> Fitch	May-July	3
	<i>Oscinella</i> sp.	May, Aug.	2
Agromyzidae			
	<i>Agromyza</i> sp.	May	1
	<i>Agromyza</i> sp.	May	1
	<i>Agromyza</i> sp.	May	1
	<i>Cerodontha denticornis</i> (Panz.)	May	1
Anthomyiidae			
	<i>Hylemya</i> sp.	May, July	26
Muscidae			
	<i>Musca domestica</i> (L.)	July	2
	<i>Stomoxys calcitrans</i> (L.)	July	1
Sarcophagidae			
	<i>Sarcophaga stimulans</i> Wlk.	July Aug.	16
Tachinidae			
	<i>Anachaetopsis tortricis</i> Coq.	May	1
	<i>Hyalomya</i> sp.	May	1
	<i>Paradidyma</i> sp.	May	1
	<i>Zenillia</i> sp.	May	1

SUMMARY

1. At least 44 species comprising 19 families of Diptera are associated with ironweed, *Vernonia interior* Small, directly by living on the plant or indirectly by utilizing the plant for shelter.

2. Five species of Trypetidae, namely *Neaspilota alba* Loew, *N. vernoniae* Loew, *N. albidipennis* Loew, *Tomoplagia obliqua* Say and *Trupanea* sp. were reared from ironweed flowers in Eastern Kansas. Approximately 90 percent of the trypetid maggots were parasitized. Twenty-two species of Hymenopterous parasites were reared from trypetid larvae, including certain species which are important parasites of crop pests.

3. Over 50 percent of the ironweed stems were infested by a cecidomyiid gall-former, *Lasioptera vernoniae* Beutm. From galls of this insect 11 species of Hymenopterous parasites were reared.

4. The larvae of an unidentified *Agromyza* were present in approximately 12 percent of the ironweed stems.

5. Thirty-four species of Diptera representing 18 families were collected from ironweed.

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NEW NORTH AMERICAN MUSCOIDEA
(TACHINIDAE, DIPTERA)¹

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The new species here described were received from several different sources in the United States as mentioned below. Two of the new forms are of special interest since they seemingly belong to genera heretofore known only in Europe. All the species are represented in my collection by the type specimens.

Minella americana, n. sp.

Male.—Front at vertex reduced to width of ocellar triangle, strongly narrowed before latter and thence widening sharply downward to almost eye width at base of antennae; frontal profile strongly sloped, about one and one-half times facial; oral margin axis as long as antennal; frontal stripe black, tapering upwards and reduced to a line before ocellar triangle; parafrontals subsilvery, moderately beset with bristly hairs on lower part which descend on parafacials to level with apex of second antennal segment; frontal bristles hardly differentiated except two or three pairs immediately above base of antennae, stopping well before triangle; ocellars and verticals vestigial; face blackish, gray pollinose, hardly impressed with lower edge or oral margin slightly produced, lateral ridges not prominent bearing two or three hairs above vibrissae; latter on level with oral margin; parafacial subsilvery, bare on lower two-thirds and subequal width of third antennal segment; cheek blackish and thinly gray pollinose, clothed with fine brownish black hairs, in profile about one-fifth eye height; antennae wholly black, nearly as long as face, narrowly separated at base, first segment very short, third but slightly longer than second; arista rather short, micro pubescent, blackish, thickened near base, middle segment short; haustellum moderately slender, nearly two-thirds head height; palpi black, slender with tips slightly thickened; eyes large, decending about to level with vibrissae, distinctly clothed with short pale hairs; back of head flat, mostly subshining, rather sparsely beset with black hairs above which become denser and longer below middle.

Thorax including scutellum shining black, with humeri showing a whitish bloom when viewed from above. Chaetotaxy: acrostichal 1, 1 (both pairs weak); dorsocentral 2, 3; humeral 2; posthumeral 1; presutural 1 (outer); notopleural 2; intraalar 2; supraalar 3; postalar 2; sternopleural 2; pteropleural 0; scutellum with 2 lateral and a strong decussate apical pair, no discals; propleura and prosternum bare; calypters opaque, with a uniform tawny tinge.

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Abdomen rather broadly ovate, wholly shining black without a trace of any pollen, all segments above sparsely beset with erect longish hairs; first segment with one pair of not very strong median marginal bristles, second with one pair of differentiated discals and a marginal row, third and fourth segments each bearing a discal and a marginal row; genitalia moderately large and in repose curved beneath the apex of abdomen.

Legs black, moderately long, without any strong bristles; mid tibia with two bristles on outer front side near middle; hind tibia not ciliate; claws about equal length of apical tarsal segment, pulvilli slightly shorter.

Wings reaching well beyond tip of abdomen, yellowish at base and along costal margin; veins including costa yellow; former bare except third which bears three small hairs near base; fourth vein with a broadly rounded stumpless bend, thence almost straight joining third at costa near the extreme wing tip; hind cross vein oblique to fourth which it joins slightly nearer bend than small cross vein; last section of fifth vein short; costal spine minute; epaulets black. Female not known.

Length, 5 mm.

Holotype: Male, Amherst, Ohio, May 31, 1931 (A. J. Barckert).

The species differs from the genotype, *Minella* (*Ptilops*) *nigrita*, in rather slight characters. It is smaller in size; the hairs on parafacials do not descend to middle of same; vibrissae on level with mouth; abdominal hairs sparser, longer, and the bristles generally weaker. A second European species, *M. chalybeata*, has the front less constricted before the ocellar triangle and is much more heavily bristled than the genotype or the present species. Hitherto the genus has been known only from Europe.

***Histochoeta claripennis*, n. sp.**

Similar to the genotype *H. marmorata* of Europe, but the arista with a distinctly longer middle segment and intermediate abdominal segments are without discals. Other differences are mentioned below.

Male.—Head much wider than high, frontal profile about two-thirds facial, antennal axis high above eye middle and little longer than oral margin axis; front at vertex 0.47 of head width (one specimen), hardly at all widened downward; frontal stripe red, equibroad, wider than one parafrontal; frontals rather short, in an irregular row which diverges sharply beneath antennal base reaching level of arista; orbitals about four proclinate and three reclinate besides some additional bristles between latter and main frontal row; ocellars strong, widely divaricate, not inclined forward; verticals two strong pairs,

inner longest, subreclinate; parafrontals blackish near vertex with somewhat denser gray pollen downward and becoming silvery on the parafacials; antennae as long as face, black, third segment strikingly elongate and stout, basal ones short; arista bare, black, thickened to tip, penultimate segment two to three times longer than wide; face hardly receding, deeply impressed, its ridges high, bristled on lower three-fourths; epistoma bowed forward from clypeal plane but not protuberant in profile; vibrissae on oral margin, moderately stout and decussate; parafacial bare, nearly two-thirds width of clypeus; eyes bare; cheek thinly gray pollinose on black ground color below becoming reddish above middle, fully two-fifths eye height; proboscis shorter than head height; palpi brown, bowed upward near middle and a little thickened apically; back of head with dense ruff of pale or whitish hairs.

Thorax black rather lightly dusted with grayish pollen, notum not distinctly vittate; scutellum black with narrow apex reddish, disk faintly pollinose. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; intraalar 3; supraalar 3; notopleural 2; humeral 4; posthumeral 2; presutural 2; postalar 2; intrapostalar 1; sternopleural 2, 2; pteropleural 1 (small); scutellum with 4 lateral, 1 good-sized decussate apical and 1 smaller discal pair; prosternum haired, propleura bare; calypters opaque, white.

Abdomen subconical, black, thinly dusted with gray pollen above but the hind margins of last three segments blacker and more shiny in some views; basal segments each with a pair of median marginals; third with a marginal row and some erect bristly hairs at middle above; fourth segment rather thickly bristled on most of upper surface; genitalia black, small and retracted; sternites covered.

Legs black, moderately stout; middle tibia with a row of four or five unequal bristles on outer front side, two near middle long; hind tibia with a row of irregular-sized bristles on outer posterior edge; claws and pulvilli somewhat shorter than apical tarsal segment.

Wings hyaline; normal in shape, extending a little beyond tip of abdomen; first vein bare, third with two or three bristly hairs near base; fourth vein with an obtuse angular bend thence nearly straight in an oblique direction to costa nearly closing first posterior cell well before extreme wing tip; hind cross vein slightly bicurved, joining fourth about three-fourths distance from small cross vein to bend; last section of fifth vein short; epaulets and subepaulets black; costal spine small. Female unknown.

Length, 8 mm.

Holotype: Male, Park City to Silver Lake, Utah, September 11, 1917 (R. C. Shannon).

This is apparently the first record of the genus from North

America. I have followed European Dipterists in the use of the emended spelling of the generic name; Townsend (Manual of Myiology, Part X, p. 325) redescribed the genotype under the name *Istocheta*.

Achaetoneura stilla, n. sp.

A small species with minute or hairlike apical scutellars; facial ridges bristled on lower half to three-fourths; hind tibiae ciliate with one longer bristle in row near middle, etc.

Male.—Front at vertex 0.296 of head width (average of three: 0.30; 0.289; 0.301), hardly widening to middle thence rather rapidly so to base of antennae; frontal profile hardly three-fourths facial, latter receding and slightly convex; antennal axis high above eye middle, about two-fifths longer than vibrissal; frontal stripe deep brown, much narrower than parafrontal; latter with dense gray pollen usually showing a yellowish tinge; inner verticals suberect but not very long, outer pair not developed; frontals in single rows, diverging anteriorly and descending to arista level, uppermost two pairs somewhat stouter and reclinate; ocellars well developed, proclinate; no orbitals; antennae black, as long as face, third segment straight on anterior edge, six to eight times longer than second; arista blackish, bare, thickened about to middle, basal segments short; face moderately deeply impressed, gradually widened downward, gray pollinose; parafacial bare, with subshiny gray pollen, less than one-half clypeal width; vibrissae rather short, on oral margin; cheek about one-fourth eye height; eyes practically bare; proboscis short, stout; palpi yellow, rather slender, beset with a few longish hairs on lower edge; back of head flat, gray pollinose sparsely clothed with pale hairs with a few black ones behind the occipital fringe above.

Thorax black, gray pollinose, notum marked with four narrow fairly distinct blackish stripes, outer ones broadly interrupted at suture; scutellum black, lightly dusted with gray pollen. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; humeral 3; posthumeral 2; notopleural 2; presutural 2; intraalar 3; supraalar 3; postalar 2; sternopleural 2, 1; pteropleural 1 (small); scutellum with 3 lateral, 1 apical (reduced to small hairs) and 1 discal pair; posternum setose; propleura bare; calypters semitransparent, white.

Abdomen subshining black, narrow basal margin of last three segments grayish pollinose; first segment with a pair of weak median marginals, second with a stronger pair; third bearing a marginal row and sometimes with two or three irregularly placed erect bristly hairs which hardly appear true discals; fourth segment with a discal and a marginal row; genitalia small and retracted; inner forceps shiny black, united to blunt apex, hind side in profile sloping forward nearly to tip thence rather strongly curved rearward; outer forceps

as long as inner ones but thicker in profile, tips broadly rounded, with a reddish tinge, basal half or more polished black; fifth sternite black, not prominent, preceding sternites covered.

Legs black; middle tibia with one anterodorsal bristle; hind tibia with a row of slightly uneven bristles on outer posterior edge; claws and pulvilli equal length of last tarsal segment, hind pair slightly shorter.

Wings hyaline; first vein practically bare, sometimes with one or more minute hairs near apex, third vein with two or three hairs near base; fourth vein with an almost rectangular rounded stumpless bend; first posterior cell narrowly open to closed at costa shortly before extreme wing tip; hind cross vein bicurved, nearer bend than small cross vein; last section of fifth vein hardly one-third length of preceding; costal spine minute; epaulets blackish.

Female.—Front at vertex 0.33 and 0.32 of head width in the two specimens, widening uniformly to antennal base; two pairs of proclinate orbitals; outer verticals about half as long as inner ones; third antennal segment about five times second, which shows a reddish tinge; palpi thickened apically; abdomen ovate; anal opening slitlike, with a tapering blunt-tipped ovipositor retracted in lower extremity of same; claws and pulvilli short, hind tibiae ciliated as in male.

Length, 4-5 mm

Holotype: Male, College Station, Texas, September 27, 1921 (H. J. Reinhard). Allotype: Female, same locality and collector as type, June 27, 1917. Paratypes: One male, Logan Canyon, Utah, July 20, 1940 (G. F. Knowlton and D. G. Hall); one male, Dix Hills, L. I., N. Y., August 5, 1934 (Blanton and Borders); and one female, Amherst, Ohio, July, 1933 (H. J. Reinhard).

Pantagathus curulis, n. sp.

Readily distinguished from the genotype, *P. alogus*, by the absence of discal bristles on the abdomen, additional differences are listed in the following description.

Female.—Front at vertex 0.26 of the head width, widening but slightly downward; sides of front and face including cheeks gray pollinose, median stripe blackish, narrowed toward triangle, at middle about as wide as parafrontal; ocellar bristles small but distinct, divaricate and slightly proclinate; inner verticals strong, suberect, outer pair vestigial; frontals decussate, one or two pairs beneath base of antennae, uppermost pair stouter and reclinate; two proclinate orbitals; antennae reaching lowest fourth of face, blackish, third segment rather slender, nearly four times longer than second; arista finely pubescent, slender beyond middle, reddish and a trifle

thickened basally, middle segment short; face receding, rather deeply impressed, gray pollinose, its ridges with moderately strong bristles extending well above middle; parafacial bare, narrowed downward; vibrissae stout, decussate at extreme tip, situated on level with front edge of oral margin; proboscis short, labella large, fleshy; palpi normal in size, hardly thickened apically, yellow; cheek about one-fifth eye height; eyes distinctly hairy; back of head gray pollinose, moderately clothed with pale hairs.

Thorax black, gray pollinose, marked with four dorsal black stripes, the inner two narrower and not well defined behind suture; scutellum black lightly dusted with gray pollen. Chaetotaxy: acrostichal 3, 3 (pair immediately behind suture small); dorsocentral 3, 3; humeral 3; posthumeral 1; presutural 1 (outer); notopleural 2; supraalar 3 (only the middle one large); intraalar 3 (one behind suture very small); postalar 2; pteropleural 1 (hairlike); sternopleural 3, scutellum with 2 lateral, 1 strong decussate apical besides a much weaker pair on disk; no infrascapular hairs; infrascutellum normally developed; propleura bare; prosternum haired at sides; calypters opaque, white, hind lobes longer than wide.

Abdomen rather narrow and tapering to apex, intermediate segments with changeable gray pollen on about basal half remainder of each including basal and anal segments shining black; one pair of good-sized median marginal bristles on first and second segments and a marginal row on segments 3 and 4, latter without any discals; genitalia laterally compressed with ovipositor retracted within a slit-like opening behind; sternites covered.

Legs black, rather stout; hind tibiae not ciliate, middle pair with an irregular row of bristles on outer front side, one at middle stout; claws and pulvilli subequal length of apical tarsal segment.

Wings with a slight tawny tinge, hardly reaching apex of abdomen; fourth vein with an obtusely rounded stumpless bend, thence almost straight approaching costa at a rather sharp angle narrowly closing the first posterior cell well before wing tip; first vein bare, third bearing two or three bristly hairs near base; hind cross vein bicurved, joining fourth only a trifle nearer bend than small cross vein; last section of fifth vein about one-half length of preceding section; epaulets black; costal spine vestigial.

Male.—Front at vertex a trifle wider than in female, measuring 0.29 of head width in the one specimen; orbital bristles absent; third antennal segment broader and fully five times length of second; facial ridges bristled to upper fourth; genitalia black, rather small, retracted; claws and pulvilli subequal apical tarsal segment; otherwise similar to female.

Length, 7 mm.

Holotype: Female, Baton Rouge, Louisiana, August 25, 1935 (W. S. McGregor).

Paratype: Male, Griffin, Georgia, August 12, 1939 (A. T. Hardy) in Kansas University Collection.

Siphona lurida, n. sp.

Dull brownish black in general aspect; palpi blackish apically; tibiae more or less reddish; last three abdominal segments with basal bands of plumbeous pollen; etc.

Male.—Front at vertex 0.537 of head width (four measured, 0.55; 0.55; 0.53; 0.52), hardly any wider at base of antennae; frontal stripe velvety red, rather short and much wider than parafrontal; latter brownish near vertex becoming paler or grayish downward; verticals two pairs; ocellars well developed, proclinate; frontal bristles in a single row, anterior two pairs below antennal base; two proclinate orbitals, rather weak; antennae about as long as face, black, third segment rather broad and pointed on anterior apical extremity, five or six times longer than second; arista bare, elongate, thickened on proximal two-thirds, penultimate segment one-half to three-fourths as long as third; face moderately receding and but slightly impressed, its lateral ridges bare; parafacial bare, gray pollinose; vibrissae on oral margin; cheek gray pollinose on reddish ground color, fully one-half eye height; proboscis slender, elongated, two-jointed, apical segments subequal in length; palpi normal in size and shape, yellow with tips infuscated; eyes practically bare; back of head somewhat bulged, gray pollinose, sparsely short-haired.

Thorax black, pleura and humeri with lusterless cinereous pollen which becomes darker or dull brown on notum and scutellum. Chaetotaxy: acrostichal 2, 3; dorsocentral 3, 3; intraalar 3; supraalar 3; presutural 2; posthumeral 1; humeral 2; notopleural 2; postalar 2; pteropleural 1 (small); sternopleural 3; scutellum with 3 lateral and 1 small discal pair, apicals reduced to minute hairs; infrascutellum normally developed; sides of postnotum beneath calypters bare; prosternum and propleura bare; calypters subopaque, faintly tawny.

Abdomen slightly elongate, oval, black with dull brownish pollen above except on narrow basal margin of last three segments; first segment without median marginal bristles, second with one strong pair; third and fourth segments each with a marginal row; no discals; genital segments blackish, retracted; sternites covered.

Legs blackish with a reddish tinge in ground color excepting tarsi; mid tibiae with one bristle on outer front side near middle; hind tibiae not ciliated; claws and pulvilli short.

Wings gray hyaline; first vein bare, third with coarse hairs extending to small vein; fourth vein with a broad evenly rounded bend curved outward shortly before apex leaving first posterior cell nar-

rowly open slightly before extreme wing tip; hind cross vein about midway between bend and small cross vein; last section of fifth vein two-fifths length of preceding section; costal spine moderately strong; epaulets black.

Female.—Front at vertex 0.52 of head width (one specimen); antennae reddish basally, third segment hardly four times length of second, rather slender; cheek fully three-fourths eye height; palpi thickened apically; genitalia retracted, not adapted for piercing.

Length, 4.5—5 mm.

Holotype: Male, Rainier, Oregon, March 3, 1930 (R. E. Dimick). Allotype: female, Union Hills, Marion Co., Oregon, February 20, 1940 (R. E. Rieder). Paratypes; 4 males, same data as allotype.

Peleteria torta, n. sp.

Similar to *P. bryanti*, from which it differs mainly in genital characters as described below.

Male.—Front at vertex 0.37 of the head width, widening rapidly downward; parafrontals with dense gray pollen which extends down on parafacials and cheeks; frontal stripe deep red, narrower than one parafrontal; two pairs of strong verticals and proclinate orbitals; ocellars absent; basal segments of antennae yellow, third black, strongly rounded above, obliquely tapering, nearly straight below and distinctly shorter than slender second segment; palpi yellow, very slender, nearly as long as haustellum; parafacial setose, with the usual two strong bristles on outer margin near lower edge of eye; epistoma strongly produced between vibrissae; cheek three-fourths eye height, with sparse coarse black hairs; back of head thickly clothed with pale or whitish hairs.

Thorax black lightly dusted with grayish pollen; notum sub-shining except in a flat rear view which shows denser pollen interrupted by four dark stripes before suture; scutellum wholly reddish yellow; acrostichals 3, 3; dorsocentrals 4, 4; sternopleurals 3; scutellum with 4 laterals alternating short and long, 1 strong decussate apical, 1 suberect preapical, and 1 depressed discal (well behind middle of disk) besides several erect smaller bristles irregularly spaced on disk; calypters white.

Abdomen red in ground color with a broad black median stripe above which expands behind to include most of anal segment, lightly dusted with changeable white pollen; first segment without median marginals, second with one pair; third with a marginal row of about 12 strong bristles; fourth with a discal and a marginal row; genital segments reddish; inner forceps rather narrow, tapering from base to middle thence parallel to a slightly notched apex, hind surface smooth, shiny and faintly impressed on median line; outer forceps

elongate, rod-like, equibroad from base to near apex thence bowed inward narrowed and slightly twisted on long axis; fifth sternite reddish black, with the diverging lobes haired along inner margin.

Legs black, tibiae reddish in ground color; claws and pulvilli elongate.

Wings subhyaline; fourth vein with rectangular bend, thence curved outward and straight to margin narrowly closing first posterior cells far before wing tip; hind cross vein oblique, reaching fourth about two-thirds distance from small cross vein to bend; costal spine vestigial; epaulets blackish.

Length, 12 mm.

Holotype: Male, Roosevelt Lake, Arizona, March, (D. K. Duncan).

Ptilodexia agilis, n. sp.

Similar to *confusa*, but with the parafacials hairy; there are also differences in the genitalia.

Male.—Front at vertex reduced to width of ocellar triangle, narrowed downward to shortly before latter then widening rapidly to antennal base; frontal vitta deep reddish, tapering sharply upwards and obliterated behind midfront; parafrontals gray pollinose, moderately haired on broad anterior part; verticals weak and hardly differentiated; frontals in a single row extending from narrowest part of front to base of antennae; ocellars long, parallel proclinate; antennae about two-thirds length of face, basal segments yellow, third black, hardly longer than second segment; arista rather short, thickened at base, long plumose to tip, proximal segments short but distinct; face moderately impressed, its ridges haired next to vibrissae, which are set well above the slightly prominent oral margin; parafacial subequal width of face, not narrowed below, gray pollinose with reddish ground color visible on lower extremity; proboscis moderately slender, about equal head height; palpi yellow, rather short and slender with extreme tips slightly thickened; eyes bare; cheek about one-half eye height; back of head flattened, gray pollinose, moderately pale-haired.

Thorax and scutellum black, gray pollinose, notum subshining, not distinctly vittate. Chaetotaxy: acrostichal 2, 3 (none immediately before suture); dorsocentral 3, 3; intraalar 3; supraalar 3; postalar 2; presutural 1 (outer); notopleural 2; posthumeral 2 (anterior one small); humeral 4-6; sternopleural 3; pteropleural 1 (shorter than sternopleural); scutellum with 2 lateral and 1 long decussate apical, besides several irregularly placed discals; sides of postnotum beneath calypters setose; prosternum and propleura bare; calypters subopaque, with a uniform light brownish tinge.

Abdomen subshining black, dusted with changeable gray pollen, which in a flat rear view extends to hind margin on all segments; intermediate segments with two pairs of discals, first and second each with one pair of median marginals; third segment with a marginal row of 12 to 14 large bristles; fourth irregularly bristled on most of upper surface with a marginal row somewhat weaker than the discal bristles; genitalia blackish, retracted; inner forceps rather short, divided apically but the slender prongs contiguous to tip; outer forceps grooved laterally with surface of apical part shining blackish, punctate and sparsely short-haired; penis simple, jointed near middle, apical segment tapering to a pale membranous tip; fifth sternite black, with a V-shaped apical incision, lobes beset with fine black hairs.

Legs rather long and slender, black with a slight reddish tinge in ground color of tibiae; claws and pulvilli elongate; middle tibia with two bristles on outer front side near middle; hind tibia with an irregular sparse row on outer hind side.

Wings slightly brownish, darker at extreme base; third vein with three or four setulae near base; fourth vein with an almost rectangular rounded bend thence oblique towards costa narrowly closing first posterior cell well before wing tip; hind cross vein bicurved, oblique to fourth which it joins about two-fifths distance from bend to small cross vein; last section of fifth vein short; costal spine double, not very long; epaulet dark reddish.

Female.—Grayer in general aspect than male; front at vertex equal or slightly exceeding eye width; frontal stripe moderately wide but narrower than parafrontal on entire length; verticals two pairs; ocellars proclinate, divergent; two proclinate orbitals; cheek two-thirds eye height; abdominal segments two and three usually with one pair of discals but sometimes a small anterior pair present; genitalia retracted terminating in a blunt-tipped organ not adapted for piercing; wings and calypters paler than in male; legs red except tarsi, latter black; epaulets pale reddish.

Length, 8—10 mm.

Holotype: Male, College Station, Texas, October 8, 1933 (H. J. Reinhard). Allotype: female, same data as type. Paratypes: 7 males and 39 females, same locality as type, September 30 to October 19, 1933 (H. J. Reinhard).

NEW THEREVIDAE AND ASILIDAE IN THE SNOW
ENTOMOLOGICAL COLLECTION

D. ELMO HARDY, Lawrence, Kansas

THEREVIDAE

Psilocephala squamosa n. sp.

(figs. 1a-b)

This species is related to *P. morata* Coquillett but the male genitalia, the body vestiture and the wing venation are distinctive.** It is most readily distinguished by the elongated lobes of the coxopodites, the characteristic patches of black bristles on the sternum and the squamose hairs of the abdomen and the femora. The females are best distinguished by the lack of the velvety spots on the front.

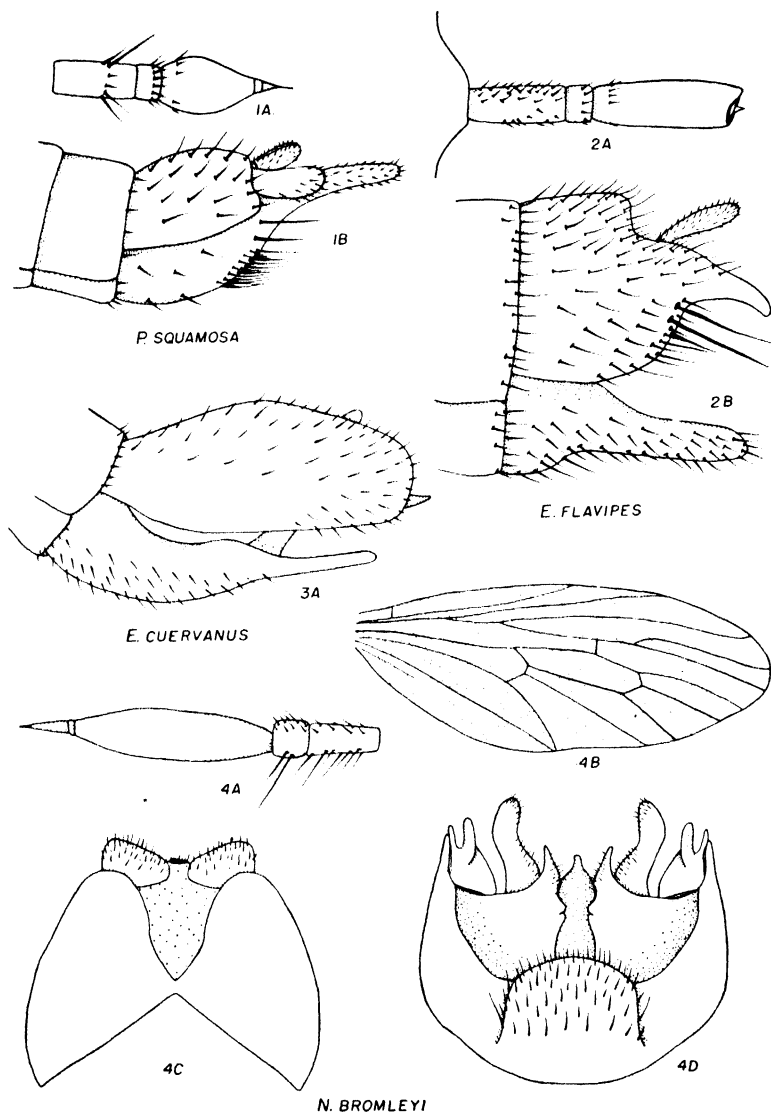
Male.—Largely black in ground color, rather densely gray pollinose. Bristles black, except for a few yellow bristles on genitalia; pile white. **Head:** Front yellow-gray pubescent on upper two thirds of frontal triangle, silvery-gray on lower portion; face and occiput gray. Mouthparts yellowish, palps long and slender. Antennae black, third segment about equal to length of first; third swollen basally but flattened laterally, decidedly more broad than first segment; arista over one-third the length of the third segment, rather slender at its tip (fig. 1a). **Thorax:** Mesonotum and scutellum evenly brownish-gray pollinose, marginal bristles strong, black. Pleurae and metanotum entirely gray. Halteres yellow. **Legs:** Coxae, trochanters and femora black, extreme apices of femora yellow; tibiae and first three tarsal subsegments yellow with black tips, apical two subsegments of tarsi black. Pile of femora chiefly scalelike. **Wings:** Hyaline, faintly iridescent; veins yellow-brown, stigma yellowish. Cell M_1 closed and petiolate, petiole equal or slightly longer than that of cubitae cell. **Abdomen:** Apical margins of segments and entire hypopygium yellow, otherwise black, silvery pollinose. Moderately to densely covered with white squamose hairs interspersed among normal hairs. **Hypopygium:** Apical processes of coxopodites greatly elongated and slender, extending two times the length of the short tergum. Each of the lateral plates of the coxopodites with a characteristic clump of strong black bristles below (fig. 1b).

Length: body, 5.0-5.3 mm.; wings, 4.0-4.3 mm.

Female.—Upper three fourths of front yellow-brown, lower portion gray, with no indications of velvety spots. Squamose pile more sparsely distributed; cell M_1 narrowly open in wing margin; abdominal terga subshining blackish brown with narrow gray vittae

*Contribution from the Department of Entomology, University of Kansas.

**The writer is indebted to Dr. Richard Dow of the New England Museum of Natural History for comparing specimens of this with the holotype of *morata* Coq.



EXPLANATION OF FIGURES

1. *Psilocephala squamosa* n. sp. a. antenna; b. male hypopygium, lateral view.
2. *Epomyia flavipes* n. sp. a. antenna; b. male hypopygium, lateral.
3. *Erax cuervanus* n. sp. a. male hypopygium, lateral.
4. *Nicocles bromleyi* n. sp. a. antenna; b. wing; c. male hypopygium, dorsal; d. hypopygium, ventral.

on apices; posterior portion of abdomen covered with short black hairs. Otherwise like male.

Holotype male: Key West, Florida, July 20, 1939 (A. T. Hardy). Allotype female and two paratype males same locality and date as type (R. H. Beamer, D. E. Hardy). All in Snow Entomological Collection.

Epomyia flavipes n. sp.

(fig. 2a-b)

This species is related to *E. ruiventris* (Loew) but is readily distinguished by the yellow legs, strongly bristled scutellum and by the elongated processes of the ninth tergum and coxopodite.

Male.—Head: Bristles of occiput black, pile of occiput and lower face white. Eyes very narrowly separated on the front, upper portion of frontal triangle velvety black, lower portion of front as well as entire face and occiput silvery gray pollinose. Front with a faint brown spot just above the base of each antenna. Antennae yellowish, third segment lightly tinged with brownish. First antennal segment short, less than three-fourths the length of the third, third segment slightly wider than first two; arista short (fig. 2a). Mouthparts chiefly black. **Thorax:** Subshining black in ground color, gray pollinose on the pleurae, lightly gray dusted on the mesonotum and metanotum. Mesonotum with an opaque black vitta extending down each side from just inside the humeri to the postalar bristles. Scutellum velvety black; halteres yellowish. Bristles of thorax black, pile yellowish-white; scutellum with four strong marginal bristles and a clump of long back hairs on each side of the disk and a few black hairs in the middle. **Legs:** Coxae and trochanters blackish, legs otherwise yellow. **Wings:** Whitish hyaline with a very faintly fumose crossband just beyond middle of wing. Veins yellow-brown, stigma yellow. Cell M_2 closed and petiolate, petiole equal or slightly longer than r-m crossvein; petiole of cubital cell twice as long. **Abdomen:** Dorsum yellow-brown in ground color, sternum more yellowish. Terga faintly silvery, especially on the first two. Segments one and two densely white pilose, especially on the sides, other segments with rather sparse, short black hairs. **Hypopygium:** Yellow-red, densely covered with reddish hairs and bristles. Ninth tergum produced into a pair of slender apical lobes extending farther than the lobes of the coxopodites (fig. 2b), under side of tergum with two especially strong bristles near apices on each side.

Length: body, 6.9-7.3 mm.; wing, 5.4-5.6 mm.

Female unknown.

Holotype male, Brownville, Texas, June 29, 1938 (R. I. Sailer). Paratypes, three males, same locality and date (R. H. Beamer, R. I. Sailer). All in Snow Entomological Collection.

ASILIDAE

Erax cuervanus n. sp.

(fig. 3a)

A small, yellow-gray pollinose species related to *E. wilcoxi* Bromley but the body bristles and hair are almost entirely white or yellowish with only a few short black bristles in median portion of mesonotum. Furcation of third vein (base of vein R_1) opposite the fork of M_{1+2} . Femora entirely reddish, not black as in *wilcoxi*. The abdominal tergites are not black banded and the male genitalia are differently shaped. The wing venation places it in the *aridus* group and the species runs to *pratti* Hine in Hine's³ and in Bromley's⁴ keys to the *Erax*, but is distinguished by the white bristles on the mesonotum, the red legs, the reddish brown abdomen and much smaller size.

Male.—**Head:** Silvery white pollinose, vestiture entirely white except for the black bristles of the palpi. **Thorax:** Silvery gray pollinose on the pleurae, scutellum, metanotum and sides of mesonotum, dorsum grayish brown. The median and anterior portions of mesonotum possess short black bristles, the posterior portion of mesonotum is thickly covered with strong white bristles. Vestiture of scutellum white. Halteres entirely yellow. **Legs:** Coxae black in ground color, silvery white pollinose. Legs otherwise yellowish red except for the extreme apices of femora and blackened apical sub-segments of tarsi. Bristles and hairs white, except for the black bristles on undersides of tarsi. Wings hyaline, faintly iridescent. **Abdomen:** First two segments black, otherwise somewhat reddish in ground color. Venter, sides and extreme posterior and anterior margins of terga densely yellow-gray pollinose. Central portions of terga opaque reddish. Pile yellow-white, very sparse on dorsum, more abundant on sides and venter. **Hypopygium:** Reddish, dorsal portion of ninth tergum thickly covered with short black hairs, all other vestiture yellow. Tergum gently rounded above, the processes of the coxopodites are rather bluntly pointed and extend almost to apex of tergum (fig. 3a). From dorsal view the hypopygium is narrower at base and broadens apically as in *pratti*.

Length: body, 10.0-10.4 mm.; wing, 7 mm.

Female.—Fits the above description except for sexual characters.

Length: body, 11.4-12 mm.

Holotype male, Cuervo, New Mexico, June 23, 1940 E. E. Kenaga. Allotype female and eight paratypes, six females and two males, same locality and date (R. H. Beamer, D. E. Hardy, L. C. Kuitert). All in Snow Entomological Collection.

3. 1919, Ann. Entom. Soc. Amer. XI, 115.

4. 1934, Ann. Entom. Soc. Amer. XXVII, 87.

Nicocles bromleyi n. sp.

(figs. 4a-d)

This species is unique from all other Nearctic *Nicocles* known to the writer by having the wings almost entirely blackish fumose with only the apices hyaline. The short antennal style places this near *N. pictus* Loew, but the wing coloration, the bright yellow halteres and small size will readily distinguish it.

Male.—**Head:** Bristles and hairs chiefly whitish or faintly yellowish, those of ocellar tubercle and the bristles of the front along eye orbit yellow-brown. Face and occiput silvery pubescent, front and vertex brownish yellow. Antennae entirely black, with yellow brown bristles on first two segments. The third antennal segment is nearly twice as long as the first two and the antennal style is about one-fourth the length of the third (fig. 4a). **Thorax:** Polished black in ground color, pleurae and metanotum densely silvery pubescent, mesopleurae and metapleurae sometimes with golden pubescence. Mesonotum with a large shining black area on each side, these areas extend three-fourths the length of the mesonotum and are much broader than the opaque median stripe. Frontal portions of mesonotum, margins and median stripe chiefly gray to yellow-gray or yellow-brown pubescent; median area with two longitudinal brown vittae extending almost to scutellum, these are separated by a thin gray to yellowish line down the middle. Hairs and bristles of thorax chiefly dark yellow. Halteres bright yellow. Scutellum polished black except for median spot of silver or golden pubescence. **Legs:** Coxae, trochanters and tarsi black; front and middle femora chiefly black, only apices rufous. Hind femora chiefly rufous with a brown to black stripe longitudinally on the dorsal surface. Tibiae rufous with only extreme apices black. Bristles and hairs of legs yellow. **Wings:** Almost entirely dark brown fumose with only the apical fourth of the wing hyaline. The brown coloring extends about to the end of the first longitudinal vein (R_{1+2}) (fig. 4b). **Abdomen:** Chiefly polished black, with a faint bluish sheen, sparsely covered with short yellow hairs. The fifth and sixth terga are silvery, the fifth is about four times as wide as long. **Hypopygium:** The ninth tergum is not greatly developed and is almost divided into two plates by posterior and anterior concavities (fig. 4c). The coxopodites are complexly developed and difficult to interpret. The posterior lateral margins terminate in a pair of narrow lobes, extending almost to apices of claspers. Claspers bilobed and rather small. Aedeagus with complex accessory structures, including a pair of long clasper-like lobes extending out on each side (fig. 4d).

Length: body, 7.0-7.4 mm.; wing, 6.0-6.4 mm.

Female.—Like the male except for sexual characteristics as typical of members of this genus.

Holotype male, Sunnyside Canyon, Hauchuca Mountains, Arizona, July 9, 1940 (R. H. Beamer). Allotype female and ten paratypes, five males, five females, same locality and date (R. H. Beamer, D. E. Hardy, L. J. Lipovsky).

THE OCHTERIDAE (HEMIPTERA) OF THE WESTERN HEMISPHERE

DOROTHYDEAN VIETS SCHELL, Lawrence, Kansas*

I have received assistance in many ways by various entomological workers in the preparation of this paper. Expression of gratitude is made: to Doctor H. B. Hungerford, of the University of Kansas, under whose direction this work was undertaken; to Doctor R. H. Beamer, of the University of Kansas, for his kind interest and cooperation; to Doctor Kathleen Doering for her valuable criticism of the illustrations; to Mr. H. G. Barber, of the Bureau of Entomology and Plant Quarantine, for his cooperation in loaning specimens for study; to Doctor Frank Lutz, of the American Museum of Natural History, for loaning specimens; to Dr. C. J. Drake, of the Iowa State College, for his cooperation in making specimens available, and, to Mr. John Lutz, of Philadelphia, Pennsylvania, for his kind cooperation in sending specimens from his private collection.

The Ochteridae make up a small family of littoral Hemiptera which seem to be a connecting link between the Gelastocoridae of the Cryptocerata and the Saldidae of the Gymnocerata group. The family is represented by only a few species, and these are remarkably uniform in appearance.

In 1807, Latreille (Genera Crust. Ins., iii, p. 142) designated the genus *Ochterus*, with *Ochterus marginatus* Latreille as the genotpye. However, in 1809, the same author changed the generic name to *Pelogonus* (Genera Crust. Ins., iv, p. 384). This change was made because of the resemblance of the name *Ochterus* to *Ochthera*, a genus of Ephydridae (Diptera) which Latreille himself had described in 1804.

Consequently, Doctor Bergroth, (Bull. Soc. Ent. Fr., 1890, pp. lxvi, cxix) realizing that this change to *Pelogonus* violated the rule of priority, changed the name back to its original form, *Ochterus*. The literature, therefore, often refers to this family as the Pelogonidae, and to the typical genus as *Pelogonus*.

*Contribution from the Department of Entomology, University of Kansas.

The Ochteridae are small, oval, brown or blackish insects. The eyes are strongly convex; two ocelli are present. The antennae are four-segmented, shorter than the head, and with the two basal segments shorter than the distal segments.

The front and middle tarsi are two-segmented, and the hind ones are three-segmented, the basal segment in all three pairs being very short. The rostrum is long, reaching the hind coxae, its basal joint is stout, with the remaining segments slender.

The Ochteridae differ from the Gelastocoridae in having the fore legs slender and fitted for running, and in having the short antennae exposed. The resemblance between the Ochteridae and the Saldidae is a superficial one. The genital armature of the Saldidae differs greatly from that of the Ochteridae. The males of the Saldidae have the eight abdominal segment narrow, ring-like and not divided into two lobes; in the Saldidae, the number of tarsal segments is three in all pairs of legs, and the rostrum is three-segmented.

Two genera have been described in this family. One of these, however, is confined to the old world. Kirkaldy (Pro. Ent. Soc. Wash., 1909, vol. 10, p. 179) lists *Peloridium* as a genus of Ochteridae, with a single species, *P. hammonionum* Breddin. However, the author feels that this species should remain, as originally described, in the family Peloridiidae. A key to the two genera of Ochteridae follows:

- A. Head in front prolonged in a horizontal plate over the base of the rostrum: membrane of hemelytra with more than twenty cells ----- **Megochterus**
Jaczewski
(Only known species is the genotype, *Megochterus nasutus* (Montandon) whose habitat is Australia.)
- AA. Front of head blunt; membrane of hemelytra with seven cells ----- **Ochterus**
Latreille
(*Ochterus marginatus* Latreille is the genotype).

Only one of these genera, *Ochterus*, is found in the western hemisphere. It is characterized by having the third and fourth antennal segments slender, the embolium comparatively wide, the membrane with seven cells arranged in two rows: four cells in the basal row and three in the apical one. However, the veins are not always distinct.

Due to the remarkable uniformity and resemblance among the members of this genus, the most accurate means of separating the species seems to be by the examination of the genital capsule of the

male, and, particularly, the right paramere. The internal genitalia of those species in which males were available for dissection are illustrated in this paper. However, in the key, an effort was made to separate the species, where possible, by means of characters other than those of the genital armature.

The males show a distinct asymmetry in the abdominal segments, although it is not as strongly developed as in the Corixidae. It is first evident on the sixth segment which shows a very slight asymmetry on the lateral parts.

The seventh segment is much more feebly developed than those preceding. The lateral areas form two almost independent lobes, of which the left one is larger. The eighth segment is divided longitudinally into two lateral lobes, which form the caudal end of the abdomen. The right lobe is more strongly developed than the left. The ninth segment is incorporated into the genital capsule, and normally is not exposed. Occasionally a part of it can be seen through the median division of the eighth segment.

The ninth abdominal segment is boat-like in shape, strongly asymmetrical, and twisted to the right. The sternal part of the segment is convex, forming a large genital chamber. The tergal part is less heavily sclerotized. The parameres are distinctly asymmetrical. It is the shape of the right one of these structures that bears significant specific characters. The left paramere is greatly reduced, and resembles the basal part of the right one.

The right paramere is curved, with an elbow-bend. In the American species of *Ochterus*, the tip is either a simple shaft or at most bears teeth or flattened lobes. However, in the old world species, the right paramere is provided subapically with two lateral appendages.

The marked reduction in the size of the ovipositor in this family seems to substantiate the suggestion that the eggs are deposited upon the surface of various objects, and that they are not embedded in plant tissue.

The life history of this family is little known. The members are predacious, and Uhler reports that the rostrum is a dreadful instrument, sharp as the finest needle, and that it is a deadly probe to the larvae of horseflies or other insects that live near the surface of the ground near water. These insects are also capable of jumping considerable distances.

The eggs, as previously mentioned, are deposited upon the surface of grains of sand, plant detritus, and other similar materials.

These bugs have a wide distribution in the western hemisphere, but they seem to be more abundant in Insular and Central America. Distributional notes accompany the description of each species.

KEY TO THE OCHTERIDAE OF THE WESTERN HEMISPHERE

Genus *Ochterus* Latreille

1. Anterior angles of the pronotum with pointed projections; a series of yellow spots along the external margin of hemelytra (fig. 1) *--perbosci* (Guerin)
Anterior angles of pronotum without projection-----2
- (1) 2. Frons metallic green -----3
Frons black or very dark -----6
- (2) 3. Pale yellow band behind ocelli; underneath part of body greenish black-----*splendidulus* (Mont.)
Without pale band behind ocelli-----4
- (3) 4. Labrum and rostrum light yellow -----5
Labrum and rostrum brown (fig. 2)-----*hungerfordi* n. sp
- (4) 5. Right paramere with retrorse prominence on inner margin (fig. 3) -----*viridifrons* (Champ.)
Right paramere club-shaped (fig. 4) *acutangulus* (Champ.)
- (2) 6. Entire dorsum light rich brown (fig. 5)-----*parvus* n. sp.
At least some part of dorsum black -----7
- (6) 7. Clavus lemon yellow (fig. 6) -----*flaviclavus* Barber
Clavus not yellow -----8
- (7) 8. Posterior half of pronotum and hemelytra except membrane, ferruginous (fig. 7)-----*brunneus* Hunger.
Posterior half of pronotum not ferruginous-----9
- (8) 9. Lateral margin of pronotum with an almost spherical spot near anterior angle (fig. 9) *americanus* Uhler
Lateral margins of pronotum broadly pale -----10
- (9) 10. Right paramere with distinct hook at tip (fig. 10)
-----*aenifrons* (Champ.)
Right paramere without hook at tip-----11
- (10) 11. Right paramere with two teeth on inner side (fig. 11) -----*bidentatus* n. sp.
Right paramere without distinct teeth on inner side----12
- (11) 12. Right paramere with enlarged tip, and a series of very fine teeth on outer side (fig. 8)-----*barberi* n. sp.
Right paramere without series of fine teeth-----13
- (12) 13. Right paramere with semi-heart-shaped lobe on outer margin (fig. 12) -----*banksi* Barber
Right paramere without semi-heart-shaped lobe (fig. 13) -----*manni* Hunger.

One species, *Ochterus victor* (Bolivar) is not included in this key. No specimens were available for study, and the author's description failed to give any characters that would readily distinguish it from its allies.

DISCUSSION OF SPECIES

Ochterus perbosci (Guerin)

Guerin, 1843, *Revue Zoologique*, p. 113.

"Very similar to *Ochterus marginatus* of our country, but larger. Under and upperside black; front a beautiful dark metallic green. Upperside of prothorax and the elytra dusted with either gilded or very brilliant scales. A very small yellow spot at the anterior angles of the prothorax; elytra having at the base three spots upon the external margin and two in the middle, of a brownish yellow. Legs yellow with the upper side of the femur and tibia brown.

Length.—6.5 mm., width, 4. mm.

Discovered by M. Perbosci, surgeon of the sea, in the Bay of Campeche, Mexico."

Comparative notes: This species is one of the largest of the genus. It is closely related to *O. aenifrons*, but the small, pointed projection on the anterior angle of pronotum, and the series of yellow spots along the external margin of the hemelytra easily separate it from other Ochteridae.

The femora of the fore legs are clothed with long fine white hairs. The rostrum is black; the basal half of the fore coxae are dark brown and glabrous. The third and fourth antennal segments are equal, with the fourth slightly larger in diameter.

Genital armature: The genital capsule is large and the right paramere bears two small rounded lobes on the outer margin (Fig. 1).

Distributional notes: The type of this species was collected in the Bay of Campeche, Mexico. The Francis Huntington Snow Collection has representatives of this species from Brownsville, Texas; Mexico; Peru, South America; Ecuador, South America; Paraguay, South America; Costa Rica; and Guatemala. I also examined four specimens from the United States National Museum: two from Grenada, West Indies, one from St. Vincent, British West Indies, and one from Guatemala.

Ochterus splendidulus (Montandon)

Montandon, 1898, *Hemipteres Heteropteres Nouveaux des Collections du Museum de Paris*, *Bulletin du Museum d'Histoire Naturelle*. Translation of the original description follows:

"Oval, short, with lateral sub-parallel sides, tapering evenly in

front and behind; velvety greenish black with a pale yellow margin on the sides of the pronotum, of the margin and posterior border of the elytra. Underside of body blackish; legs, rostrum and antennae yellowish.

"Head smooth, without a trace of a longitudinal carina; very finely rugulose transversely, of a beautiful brilliant metallic green with a narrow pale yellow border on the anterior edge, sometimes uneven on the inner side, originating at each side of the inner margin of the eye, a little in front of the sub-rounded lobe of the projection which emarginates the eye at its posterior margin; this lobe is itself a brownish yellow over all its surface, or at least on its posterior periphery, with a small black splotch in front, that is, behind the inner posterior angle of the eye. Between these two projections, the rather convex posterior part of the head is crossed by a pale yellow band, transverse and regular, which passes just behind the ocelli straight across, very feebly sinuate in the middle on its posterior margin. Lateral sides of the pronotum rather widely explanate, feebly arched on the outside with a pale yellow border, slightly burnished on the outer side, almost equal in width from the anterior angle up to the lateral angle; posteriorly, slightly widened beyond the middle. Surface of the pronotum without apparent punctations, of a beautiful greenish black, velvety and uniform.

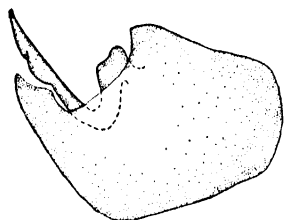
"Elytra of the same color as the disc of the pronotum with a wide pale yellow border slightly darkened on the outer edge, on the basal two-thirds; on the posterior third, the elytral margin is only very slightly darkened to the tip. A narrow pale yellow subapical band, a little vermiculate and irregular on its sides, extends obliquely from the apex of the clavus up to the outer margin of the elytra. The extreme tip of the clavus brownish yellow. Membrane black, elytra with invisible suture.

"Underside of body dark, darker and velvety on the underside of the thorax, with the dilations of the pronotum and part of the elytral margin widely bordered with pale yellow beneath. Abdomen covered with grayish, fine and quite a dense, pubescence. Antennae pale yellow. Rostrum and legs entirely testaceous yellow with the tip of the last segment of the tarsi a little darkened. Tibia spiny, and the spines uniformly colored, directed a little backwards, not quite as long as the diameter of the tibia.

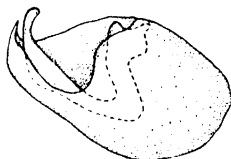
"Length.—6.7 mm., width 4.7 mm. Nanegal, Ecuador, (V. Ortenada and my own collection).

"This magnificent insect must be quite closely related to *P. victor*, Bolivar de Pichincha, Ecuador, being almost the same size, having the same absence of carina on the head, and almost the same

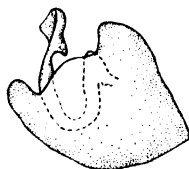
PLATE I.



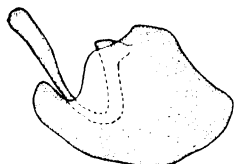
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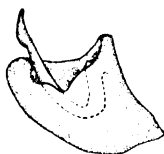
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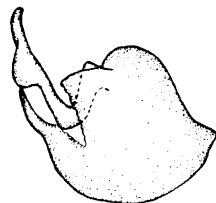
3 O VIRIDIFRONS



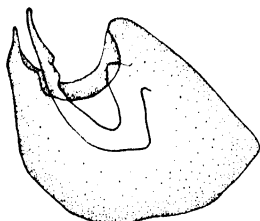
4 O ACUTANGULUS



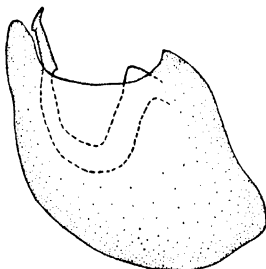
5 O PARVUS



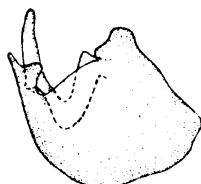
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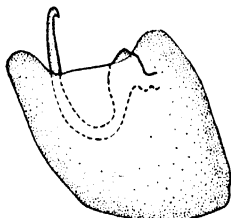
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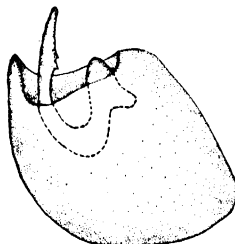
8 O BARBERI



9 O AMERICANUS



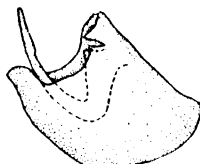
10 O AENIFRONS



11 O BIDENTATUS



12 O BANKSI



13 O MANNI

color, as much as one can judge by the very brief description of the author. In any case it differs from it by the general dark greenish color on the underneath part of the body, no *niger subviolaceous*, by the entirely black membrane, not having *marginibus dilutioribus*, and by the absence of small yellow points on the corium; by the lateral margins of the pronotum being entirely yellow on their whole length, and not *pronoti marginibus lateralibus antice flavis*, as the author says for *P. victor*.

"The observation from which Mr. Bolivar has made his description of *P. victor* (Ann. Hist. Nat. Esp., 1879, p. 144) 'Es el primer *Pelogonus* encontrado en America' is not exact; Guerin described *P. perbosci* in 1883 from the Bay of Campeche, and North America also has a species described since 1875, *P. americanus* Uhler, closely related in size and coloration to our European form, but differing from it by the lateral margin of the pronotum being more strongly arched, especially in front where the pronotum tapers more suddenly, still remaining, however, wider than the head, including the eyes, the anterior angle of the pronotum being outside of the outer edge of the eyes, while, on the contrary, it is found within the outer limits of the eyes in the case of *P. marginatus* Latreille, which is spread over a large part of the old world as far as Oceania; my collection has some specimens of it from Cochin, China, Sumatra and New Caledonia. The small yellow spot on the lateral margin of the pronotum, in the case of *P. marginatus* Latreille is longer than wide, and follows the anterior part of the outer margin, while, in the case of *P. americanus* Uhler, this spot is smaller, very narrow, wider than long, and is not widened on the external margin. The anterior part of the head in the case of the latter, is less rugulose, almost smooth and appears a little more prominent in front of the eyes; the median longitudinal line of the head is very feeble, almost as in the case of *P. marginatus* Latreille."

Comparative notes: I was not able to secure specimens of this particular species for study. However, I placed it in the key, separating it from other members of the genus by the presence of a yellow band across the head behind the ocelli, and by its greenish black color. The author has given a number of comparative features which I have included in the translation above.

[To be concluded in the April Issue]

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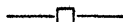
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THE OCHTERIDAE (HEMIPTERA) OF THE
WESTERN HEMISPHERE

DOROTHYDEAN VIETS SCHELL, Lawrence, Kansas

[Continued from the January issue]

Ochterus hungerfordi, n. sp.

Size.—4 mm. in length; 2 mm. in width.

Color.—Dorsum black with the usual bluish-grey markings and short golden flecks. Expanded lateral margins of the pronotum straight and yellowish. Frons slightly carinate between the eyes, metallic green and finely rugulose. Venter of thorax pruinose; venter of abdomen pubescent. Acetabulae, legs, first and second antennal segments, yellowish. Labrum and rostrum brown.

Structural characteristics.—Width of base of pronotum twice that of apex. Interocular space equal in width to width of eye from face view. Antennae not extending to margin of pronotum. Third and fourth antennal segments subequal in length; fourth slightly larger in diameter.

Genital armature.—The genital capsule has a narrow pointed tip that extends almost to the tip of the right paramere. The right paramere is expanded about one-fourth of distance from tip to bend, being almost twice as wide as at the apical part. (Fig. 2).

Comparative notes.—This species resembles *O. viridifrons* and *O. acutangulus* in having the frons metallic green. However, each of these species has large protruding eyes, and lemon yellow labrum and rostrum, while the eyes of *O. hungerfordi* are normal size and the labrum and rostrum are brown.

Distributional notes.—The type of this species is deposited in the Francis Huntington Snow collection. It was collected by P. J. Bermudez, 1932, in Mantanzas, Mumuri Valley, Cuba. Holotype ♂; allotype and two paratypes. One female specimen was examined from the United States National Museum from Baracoa, Cuba.

Ochterus viridifrons (Champion)

Champion, 1901, *Biologica Centrali-Americana*, Rhynchota, Vol. II, pp. 345-346, pl. 20, fig. 14.

"Broad ovate, black; the head from the ocelli forwards shining and of a brilliant metallic-green color, the rest of the surface opaque; the labrum and antennae, the sides of the pronotum narrowly, except at the lateral angles, the outer margin of the corium, the rostrum, some marks on the pleura, and the coxae ochreous, the basal margin of the pronotum and the claval suture inclining to

ferruginous, the pronotum, scutellum, and elytra also with some irregular bluish-gray markings; the legs infusate, with the base of the femora ochreous, in one specimen almost entirely ochreous; the upper surface with very minute scattered golden scales, the under surface with a bluish-white pubescence. Face densely, irregularly rugulose, carinate between the eyes; the latter large, very prominent in the male, less so in the female. Pronotum, scutellum and elytra sparsely distinctly punctate; pronotum short, nearly twice as wide at the base as at the apex, the sides somewhat rounded and converging from the base, the anterior angles completely effaced, the lateral angles subacute and projecting a little beyond the elytra; elytra widening to near the middle; nervures of the membrane indistinct. Fifth ventral segment carinate down the center in the male.

Length.—4.25-5.5 mm. Breadth 2.5-3.1 mm: (♂ ♀):

"Habitat.—Guatemala, Rio Naranjo, San Geronimo (Champion). A male from Rio Naranjo and a female from San Geronimo, the latter much the larger of the two, and with the legs almost entirely pale, the ochreous lateral streaks on the pronotum become, as usual, a little wider forwards."

Comparative notes: This species is remarkably similar to *Ochterus acutangulus*. In our series from Costa Rica, *O. viridifrons* has the lateral margins of the pronotum arched, while those of *O. acutangulus* are straight. However, a series from Canal Zone, Panama from Doctor C. J. Drake's collection, undoubtedly *viridifrons*, have the margins straight.

Genital armature: The most accurate method of separating these two species (*viridifrons* and *acutangulus*) is by genital characters. The right paramere of *viridifrons* has a sharp curved tooth on the inner margin, giving it the appearance of an asymmetrical spear. (Fig. 3). The right paramere of *acutangulus* is club-shaped, without teeth.

Distributional notes: The Francis Huntington Snow collection contains a series of twenty-six specimens from the San Jose, Costa Rica. One female specimen from the United States National Museum, bearing a Grand Canyon, Arizona label, appears to be *viridifrons*, but an examination of the male genitalia would be necessary for accurate determination. Specimens from Canal Zone, Panama were studied from Doctor C. J. Drake's collection.

Ochterus acutangulus (Champion)

Champion, 1901, *Biologica Centrali-Americana*, Rhynchota, Vol. II, pp. 345-346, pl. 20, figs. 15, 15a.

"♀—Broad ovate, flattened above, much narrowed behind, black; the head from the ocelli forwards shining, and of a brilliant metallic-green color in front, changing to cuprous between the eyes, the rest

of the surface opaque; the labrum, the two basal joints of the antennae, the rostrum, the sides of the pronotum narrowly, except at the lateral angles, the outer margin of the corium, some marks on the pleura, and the coxae, ochreous, the basal margins of the pronotum ferruginous, the elytra with indications of the usual bluish-grey markings; the under surface with a bluish-grey pruinosity, the legs and abdomen with a bluish-white pubescence; the legs infuscate, the femora beneath and at the base ochreous. Head punctured behind the ocelli, the face densely, irregularly rugulose in front, the interocular space carinate down the middle and almost smooth; eyes comparatively small, not prominent. Pronotum, scutellum, and elytra very distinctly punctured, pronotum short, about twice as wide at the base as at the apex, the sides almost straight, the anterior angles completely effaced, the lateral angles acute and projecting beyond the elytra; elytra narrowing from a little below the base; nervures of the membrane prominent. Legs long and slender.

"Length.—5 1/8, breadth 2 4/5 mm.

"Habitat: Guatemala, Rio Naranjo (Champion).

"One specimen from the banks of the River Naranjo in the 'tierra caliente' of the Pacific coast region. Easily separable from its allies by the acute lateral angles of the pronotum, the almost smooth interocular portion of the head, and the posteriorly narrowed elytra."

Comparative notes: As mentioned previously, this species bears a close resemblance to *viridifrons*, but can easily be separated by the club-shaped right paramere. The lateral margins of the pronotum of this species are straight while those of *viridifrons* are arched.

Genital armature: The tip of the capsule is rounded; the paramere is rather long and club-shaped. (Fig. 4).

Distributional notes: In the Francis Huntington Snow collection are found specimens from Tejupilco, Mexico and Vera Cruz, Mexico. I also examined a specimen from the United States National Museum collected in Porto Bello, Panama. This single specimen, a female, has been determined as *acutangulus* by Mr. H. G. Barber. It is slightly smaller than our specimens from Mexico, and the sides are more nearly parallel. However, it has the same green frons, yellow labrum, and acute humeral angles.

Ochterus parvus n. sp.

Size.—Length 3.3 mm.; greatest width 1.5 mm.

Color.—Dorsum strikingly reddish-brown with short golden flecks. Frons slightly darker than dorsum. Underside also brownish. Legs, acetabulae, labrum, rostrum and lateral margins of the pronotum yellowish.

Structural characteristics.—Anterior and humeral angles of the

pronotum rounded. Lateral margins gently curved. The entire lateral margin of the pronotum expanded and broadly pale. Frons slightly carinate between the eyes; frons finely rugulose. The eye width is slightly less than twice that of the interocular space as viewed from face aspect.

Genital armature: The right paramere bears a single small lobe on the outer margin near the tip. As is only logical, considering the size of the specimen, the genital capsule is quite small in comparison to other species.

Comparative notes.—This species is one of the most distinctive of the genus. Its light rich brownish color and its extremely small size make it easily separated from its allies. The right paramere shows a slight resemblance to that of *perbosci*; however, the capsule is much smaller and the paramere bears a single, barely-enlarged lobe on the outer margin. Externally they differ greatly, *parvus* being half the length of *perbosci* and brown rather than black.

Distributional notes.—Described from one male specimen collected by F. X. Williams, at Mera, Ecuador in 1923. The type is deposited in the Francis Huntington Snow collection.

Ochterus flaviclavus Barber

Barber, 1913, Canadian Entomologist XLV, p. 214.

"Brownish-black. Very much the appearance of *O. americanus*, to which it is closely related, having the usual carinate and ruglose face. However, somewhat smaller than that species with the clavus entirely yellow. The pronotum with the lateral margins gently rounded, more converging anteriorly, the anterior margin being narrower than the width across the eyes; the anterior angle of the pronotum sharply rounded and not projecting anteriorly as in *americanus*; the expanded part of lateral margins narrower, with a small yellowish spot just posterior to the anterior angle; the humeral angle almost rectangular, projecting but a trifle beyond margin of corium. Extreme edge of corium very narrowly pale but the usual pearl-grey spots. Beneath, with the sternum slate grey; the acetabula, posterior and lateral flange of the posternum, legs and venter pale; legs light infuscated. Prosternum, mesosternum externally and metasternum before the posterior angle distinctly punctate.

"Length.—3.5 mm.; width of pronotum, about 2 mm."

Described from male taken at Ormond, Florida.

Comparative notes: This species is apparently closely related to *O. americanus* as it bears the same small yellow spot on the margin of the pronotum. However, the lemon yellow clavus of this species readily separates it from other *Ochteridae*.

Genital armature: The type of this specimen was kindly loaned to me by Mr. H. G. Barber from his own private collection. The paramere and capsule are remarkably similar to that of *banksi*.

Although I can discern no specific structural differences in the paramere of *flaviclavus* and *banksi*, I am retaining it as a distinct species due to its unique color pattern. The genital capsule is illustrated in this paper. (Fig. 6).

Distributional notes: The type specimen was collected at Ormond, Florida. W. S. Blatchley (Heteroptera or True Bugs of Eastern North America, 1926, p. 1022) reports taking one female of this species at Sarasota, Florida beneath the decaying stems of pickerel-weed growing in the muck of a nearly dry wet-weather pond in open pine woods.

***Ochterus brunneus* Hungerford**

Hungerford, 1927, Proc. Ent. Soc. Wash., 29, p. 188.

"Size.—length, 4.8 mm. Width across head, 1.4 mm. greatest width, 2.5 mm.

"Color.—the general color impression, brown. Head black above. Disc of pronotum, scutellum and membrane of hemelytra, smoky-black with flecks of grey on scutellum and membrane. Lateral margin of pronotum and embolium yellowish. Remainder of dorsal surface, rich brown flecked with bluish-grey. A smoky patch on each corium and bluish-grey figure at median base and tip of scutellum and five imperfectly quadrate spots on hemelytral margin. Entire surface sparsely covered with short golden hairs. Body beneath, dark frosted with grey. Legs and antennae, nearly white.

"Structural characteristics.—Anterior tibia of male curved. Vertex of head not carinate. Anterior margin of pronotum narrower than the head. Lateral margins somewhat explanate and divergent. Third and fourth segments of antennae slender, the antennal formula being, 2d:3d:4th::5:11:11. Terminal segment slightly curved. Distal end of second segment fully twice the diameter of the third segment reaching the lateral margin of the prothorax."

Comparative notes: This species resembles *O. barberi* but it is separated from it by the distinctly ferruginous color on the posterior half of the pronotum. In *barberi* the pronotum is black and the corium is usually considerably darker than that of *brunneus*.

Genital armature: The tip of the capsule extends almost to the tip of the paramere. The right paramere bears two knobs on the inner margin. (Fig. 7).

Distributional notes: Described from two males bearing the label, "Huachi Rio Beni, Boliv. W. M. Mann. Sept. Mulford Biol. Expl. 1921-22." These specimens are in the Francis Huntington Snow collection to be returned to the United States National Museum.

***Ochterus barberi* n. sp.**

Size.—Length 5 mm. Width 2.5 mm.

Color.—The general color impression is brown to brownish-black; the pronotum is black with a ferruginous spot at the posterior end of the yellowish marginal splotch. A narrow band of ferruginous appears at the posterior margin of the pronotum in the center. The scutellum is black; the hemelytra are rich brown to ferruginous, and bear indications of two spherical yellow spots on the inner apical angles. These spots seem to vary in their degree of coloration in the various specimens. The hemelytra bear a series of yellow spots on their external margins. The labrum and rostrum are black, and the entire underside is black or dark brown.

General armature: The right paramere is very unique. It barely protrudes from the capsule. It has a tooth on the inner margin and the outer margin is very slightly serrate for a considerable distance from the tip. The aedeagus also is slightly serrate at the base. The rather large genital capsule is figured. (Fig. 8).

Comparative notes.—This species resembles *brunneus* but does not have the ferruginous coloration on the posterior half of the pronotum. It resembles *perbosci* as it has the same series of yellow spots along the external margin of the hemelytra, but it is smaller and does not bear the pointed projections at the anterior angles of the pronotum.

Distributional notes.—The holotype and allotype are deposited in the United States National Museum. The holotype, a male, was taken at Colorado Canyon, Arizona; the allotype at Hot Springs, Arizona. Another specimen in the National Museum bears the label, Orizaba, Mexico. Two specimens, paratypes, were received from the American Museum of Natural History, collected at Grand Canyon, Arizona. A series of 61 paratypes were collected at Indian Hot Springs and Castle Hot Springs, Arizona by Doctor R. H. Beamer and his collecting party in August, 1941. They are now in the Francis Huntington Snow collection.

Ochterus americanus (Uhler)

Uhler, 1884, Standard Natural History, ii, p. 262.

"Our native species, *P. americanus*, is a velvety blue, black beneath, marbled with deep black above and sprinkled with golden yellow points; the face is coal black and the rostrum piceous. Each side of the prothorax, behind the front angles, there is a bright yellow spot of variable size; the prothorax is transverse, but a little narrower than the abdomen, and the lateral margins are depressed and thin, on the costal margin of the corium five not very distinct yellow spots appear. The legs are slender, dull yellow, tinged with piceous, and the knees, tips of the shanks, and ends of the tarsi are pitch brown. This is a gay active little insect, which measures only one-fourth of an inch in length, and lives among the grass and weeds on the margins of brooks and ponds from Massachusetts to

Texas. It is also not uncommon in the island of Cuba. It differs from the very similar European species in being narrow in front, and in lacking the spots on the underside of the connexivum."

Comparative notes: This species is closely related to *banksi*, but has only a single spherical spot on the lateral margin of the pronotum. It differs from *flaviclavus* by the black hemelytra mottled with bluish-grey.

Genital armature: The genital capsule has a distinct lobe or scallop near the tip. The right paramere is broadened apically with a rather blunt tip; it also bears a tooth on the outer margin. (Fig. 9).

Distributional notes: The Francis Huntington Snow collection has only two specimens, one, a female, collected at White Plains, N. Y., the other, a male, from Mosholu, N. Y. Specimens from Cedar Bluff, Neb., Aberdeen, Miss., and "N. Ill." were examined from Doctor C. J. Drake's collection.

Ochterus aenifrons (Champion)

Champion, 1901, *Biologica Centrali-Americana*, Rhynchota, Vol. II, pp. 344-345, pl. 20, figs. 12, 13.

"Broad ovate, black; the head from the ocelli forwards more or less shining and aeneous in color, the rest of the surface opaque; the pronotum with the sides rather broadly, except at the lateral angles, and basal margin in the middle, the corium usually with from two to four small spots on the outer margin, as well as the outer edges, and often a spot near the inner apical angle, and some marks on the pleura, ochreous; the head, pronotum, and scutellum with the usual irregular bluish-grey markings; the rostrum broadly black at the base, for the rest ochreous; the legs ochreous, in some specimens slightly infuscate; the upper surface with very minute scattered golden scales, the under surface with a bluish-grey pruinosity, the abdomen with a bluish-white pubescence. Face densely rugulose. not carinate between the eyes, the latter moderately large. Pronotum, scutellum, and elytra, sparsely indistinctly punctate; pronotum, about one-half wider at the base than at the apex, the sides slightly arcuate, the anterior and lateral angles rounded, the latter not projecting beyond the elytra; elytra somewhat rounded at the side; nervures of the membrane distinct.

"Length.—3.5-5 mm. Breadth 2-2.5 mm. (♀ ♂).

"Habitat.—Mexico, Teapa in Tabasco (H. H. Smith); Guatemala, San Geronimo, Guatemala City (Champion); Panama, Tole, Pena Blanca, San Feliz (Champion). Antilles, Grenada, S. Vincent.

"Apparently a common species in Central America, whence we possess twenty-four specimens. It is very variable in size and color, some specimens having the disc of the elytra more or less ferruginous. The ochreous lateral patches on the pronotum often have a

short dark marginal streak. Differs from *O. perbosci* (which also is without a well-defined carina between the eyes) in the rounded anterior angles of the pronotum, the larger ochreous patches at its sides, the less distinctly spotted margins of the elytra, and the smaller size, and from the Palaearctic *O. marginatus* (Latr.), in the anteriorly narrowed pronotum, the narrowed head, the noncarinate face, the black labrum, etc."

Comparative notes: The author has presented a comparison of this species with *O. perbosci*. It seems to resemble closely *bidentatus* n. sp. and can be separated accurately only by the examination of the genitalia.

Genital armature: The right paramere has a distinct hook at the tip, and the shaft is simple. (Fig. 10).

Distributional notes: The Francis Huntington Snow collection has specimens from the following localities: Mexico, Costa Rica, Panama, Honduras, Ecuador, Guatemala, and Colombia, South America. Apparently this is common species in Central America. Doctor C. J. Drake has several specimens from Trinidad.

Ochterus bidentatus n. sp.

Size.—Length 4.7 mm. Width 2.4 mm.

Color.—The general color impression is black. Pronotum with broadly-expanded lateral margins yellowish darkening to ferruginous at the humeral angles. A touch of ferruginous is present at the posterior margin of the pronotum. The lateral margin of hemelytra ferruginous; entire surface covered with short golden flecks. Body beneath dark, with acetabula, lateral margin of thorax, legs and distal portion of rostrum yellowish. Base of rostrum black, as are the clypeus and labrum.

Structural characteristics: Frons non-carinate, but finely rugulose. Third antennal segment longest; distal end of second segment fully twice the diameter of third. Fourth as slender as third and about four-fifths as long.

Genital armature: The right paramere has several acute-angled notches on the inner margin which give the appearance of teeth. The tip of the genital capsule extends well up toward the tip of the paramere. (Fig. 11).

Comparative notes: This species closely resembles *aenifrons*, but the right paramere of *bidentatus* bears two sharp teeth on the inner margin, and does not have the hook at the tip.

Distributional notes: Holotype male; allotype and a female paratype from Vic. San Pedro, Peru, collected by Woytkowski. One male paratype bears the locality label "Dept. Ayacucho, Prov. La Mar Sivia, Jungle 790 m. a. s. l. Bks. Apurimac riv." and was collected in Peru by F. Woytkowski. The types are deposited in the Francis Huntington Snow collection.

Ochterus banksi Barber

Barber, 1913, Canadian Entomological xiv, p. 214.

"Broad ovate, brownish black. The head, behind the vertex, opaque, from there anteriorly, shining and obliquely, finely rugulose and tricarinate; one carina next each eye, and a median one, continuous from vertex to apex; transversely sulcate midway between ocelli and base of head. Pronotum with anterior margin almost truncated, with the anterior angles next the eyes rounded and not projecting forwards or outwardly beyond the exterior margin of the eyes; entire lateral margins gently rounding posteriorly; humeral angle rounded, not very prominent; lateral margins broadly expanded, pale; and tapering posteriorly to occupy the entire margin; the remainder of the surface brownish black, elevated and transversely, but not very deeply sulcate a very little behind the middle; posterior lobe, middle and anterior part of first lobe more coarsely punctate, the latter with two or three transverse weak furrows. Scutellum almost equilateral, rather coarsely punctate and transversely furrowed; anteriorly with a transverse elevated ridge, behind which it is depressed. Corium not demarked from membrane, broadest across the middle, with lateral margin gently rounded to just beyond the middle, where it more abruptly rounds off to the rather narrow apical part of membrane; the external margins either broadly pale throughout or in part suffused with fuscous and reflexed, without the usual series of pale marginal spots which occur in *O. americanus*. Clavus and corium, anteriorly, with coarse scattered punctures. Nervures of the membrane indistinct. General surface with indication of customary bluish-grey markings, unless denuded, when the whole upper surface is smooth and shining. Beneath on sternum and venter, paler, with rostrum, acetabulae, coxae, legs and external angle of metathorax pale yellow. Prosternum rather coarsely punctate.

"Length, 4 mm. Width of pronotum, 2 mm.

"*O. banksi* can readily be separated from *americanus* by its difference in color markings and the character of the pronotum. Apex of membrane is more narrow than in *americanus*.

Comparative notes: Mr. Barber has distinguished this species from *O. americanus* above. The right paramere of *americanus* has a blunt tooth on the outer margin as compared with the flattened lobe on the outer margin of the right paramere of *O. banksi*.

Genital armature: The right paramere bears a semi-heart-shaped lobe on the outer margin. (Fig. 12).

Distributional notes: The Francis Huntington Snow collection has representatives from White Plains, New York; Westfield, New Jersey; Vienna, Virginia; Capron, Florida.

Ochterus manni Hungerford

Hungerford, 1927, Proc. Ent. Soc. Wash., Vol. 29, p. 189.

"Size.—length, 4.1 mm. Width across head, 1.2 mm. Greatest width, 2 mm.

"Color.—Color markings not strikingly distinct. The pattern composed of the usual mottling of bluish-grey on black. Lateral and rear margin of pronotum and lateral margin of hemelytra, yellowish.

"Structural characteristics.—Anterior tibia of male curved. Antennal formula is as follows: 2d:3d:4th::5:9:9. Distal end of third antennal segment reaching the lateral margin of the pronotum.

"Comparative notes.—this species does not have a distinctive color as does *Ochterus brunneus*. It is much smaller and not marked with brown as in *Ochterus americanus* Uhler. It is about the size of some males of *Ochterus banksi* Barber, but the anterior lateral margins of pronotum are less expanded and the third and fourth segments of antennae are longer and more slender. It can not be any described species because it fails to agree in size, shape or color pattern with the species described in Central and South America."

Comparative notes: This species is closely related to *hungerfordi*, but the right paramere is a single, sickle-shaped structure, while that of *hungerfordi* has a large flattened flange on the outer margin.

Genital armature: The paramere is simple, sickle-shaped. (Fig. 13).

Distributional notes: Type described from a single male bearing the label, Huachi Rio Beni, Boliv. W. M. Mann. Sept. Mulford Biol. Expl. 1921-22. The type is in the Francis Huntington Snow collection to be sent to the United States National Museum. The Snow collection also contains specimens from Costa Rica and Peru.

Ochterus victor (Bolivar)

Bolivar, 1879, An. Soc. Espan. Hist. Nat., VIII, p. 144.

Translation of original description follows:

"♂—Black, violet tinge; head with margin and transverse posterior lines, roundish spots above the eyes, and corium with external and posterior margin, yellow; dorsal membrane concolorous, margin becoming paler; rostrum and legs yellow to ferruginous; abdomen fuscous to ferruginous, pubescent, disc black; corium with indistinct yellow punctures head slightly rugulose, without carina;

"Length, body, 0",007; width, 0",0045.

"Country.—Pichincha, Ecuador. (Martinez y Saez).

Observation.—It is the first *Pelagonus* found in America."

I was unable to secure any specimens of this species for study. Therefore, it is not included in the key.

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SOME NOTES ON THE BIOLOGY OF THE PACK RAT CUTEREBRID (CUTEREBRID BEAMERI HALL) IN KANSAS.

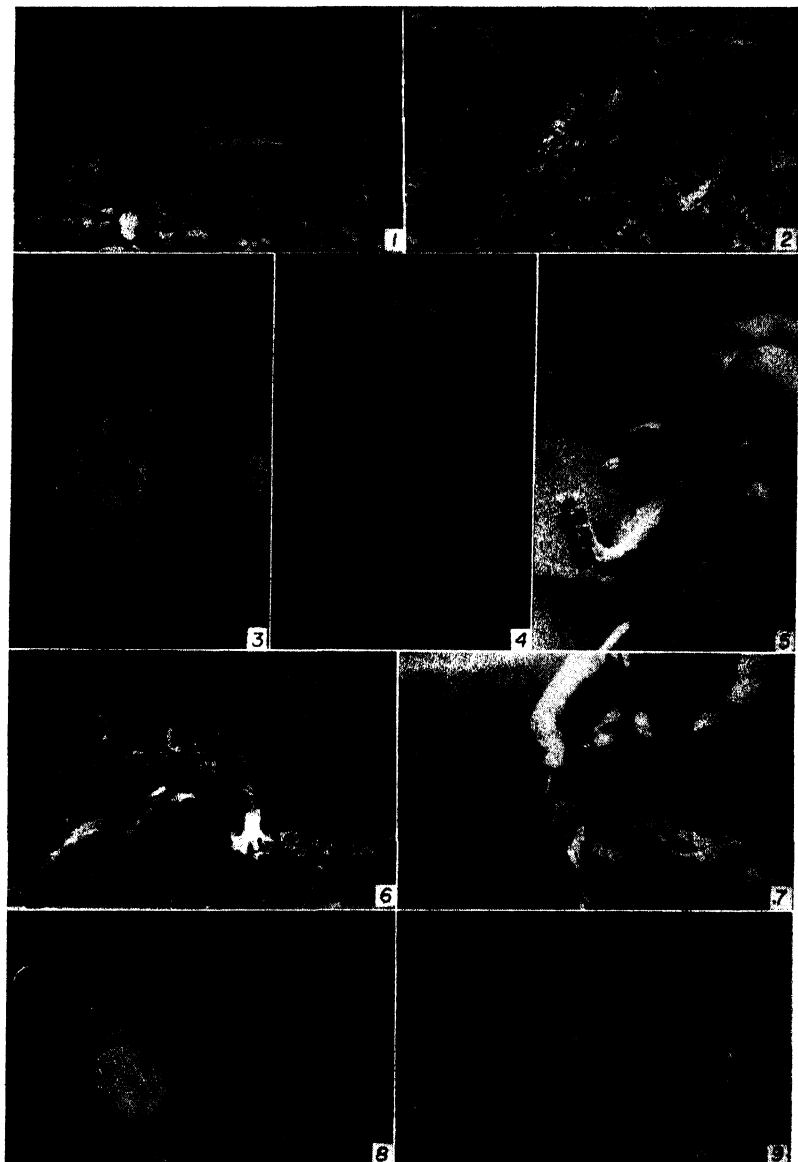
BEAMER, R. H., PENNER, L. R. and HIBBARD, C. W.

For the past several years C. W. Hibbard had noticed infestations of the pack rat, *Neotoma floridana osagensis* Blair, by large cuterebrid larvae in Greenwood County, Kansas. He had also tried to rear out adults but was not successful until the summer of 1941 when he brought in one young rat with five larvae and succeeded in having three adult flies emerge September 4, 1941. These were reported back as new by David G. Hall of the United States National Museum, with the request that more specimens be obtained if at all possible.

About the middle of May, 1942, Beamer and Hibbard examined twelve litters of pack rats at the type locality but no cuterebrid parasitism was evident. On June 19, 1942, Beamer and Penner visited the same locality and spent the next two days examining 45 pack rat nests from which they collected 26 rats. The second nest examined had one female with three young attached, all four having cuterebrid larvae and one of the young with two. All of the rats were taken to Lawrence, June 22nd, and placed in cages, usually not more than four to a cage. There was some mortality among the rats and in this way the old mother and her larvae were lost. Her young were, however, able to survive without her and all matured their warbles.

On July 2nd the first larva emerged while we were making photographs and all the larvae in this litter had emerged by July 8th. It was on this date that we discovered another fairly large rat was developing a larva. It had been missed until this time and emerged July 19th. August 19th we sifted the dirt in the rat cages and recovered five puparia. All of the larvae had emerged and pupated.

Two adult flies emerged August 23rd, a male and a female. The male did not seem to be normal and failed to fertilize the female. It died on August 26th and the female on August 27th, after laying



about 285 eggs. The female placed most of these eggs on the outside of the screen of the cage by placing the tip of the ovipositor between the meshes of the screen.

A second female emerged September 5th, began laying eggs on September 10th and died September 12th. She, like the other female, laid about 285 eggs and placed them on the outside of the wire of the cage.

The eggs are almost white, about one millimeter long, flat on one side, with the ends oval and an oval operculum on top at one end with the cap fitting well down in the opening. No small larvae have been seen. The mature, emerging larvae are slightly more than an inch in length and almost half that in thickness. They are dark brown in color and very slow in movement, although they will bury themselves in the soil in a very few minutes. As nearly as we could observe the rats paid no attention to the larvae. All larvae observed have been located beneath the skin between the front legs of the rat.

The senior author, trying to find an answer as to where this cuterebrid lays its eggs in nature, visited the type locality on September 18 1942. Thirty pack rat nests were examined in two of which cuterebrid eggs were found. One nest was under a flat stone and the first eggs were noticed on a stick in the entrance. Others were found on the underside of the flat rock. About 35 eggs were counted here. The other nest was under a large cottonwood log with the cuterebrid eggs scattered at random on the bark immediately over the entrance to the burrow. (Fig. 2.) About the same number of eggs were counted here as in the other nest. All of these eggs had either hatched or were infertile when found. These observations would tend to point to a random placing of the eggs on sticks or stones in or over the entrance to the nests of the pack rats.

The fact that adult flies emerged in September on two successive years led the authors to think there should be two generations of these flies a year. Accordingly, on September 20th near Lawrence we examined five litters of pack rats, young still attached to their

EXPLANATION OF PLATE

- Fig. 1. Typical nest of pack rat under a flat rock.
 Fig. 2. Eggs of *Cuterebro beameri* Hall on cottonwood bark removed from just above entrance of pack rat nest.
 Fig. 3. Young pack rat with two larvae of *Cuterebra beameri* Hall just before emerging.
 Fig. 4. Puparium of *Cuterebra beameri* Hall.
 Fig. 5. Young pack rat with larva almost out.
 Fig. 6. Same rat with larva just out.
 Fig. 7. The wound just after larva emerged.
 Fig. 8. View of the same rat as in Fig. 3 five days after emergence of larvae.
 Fig. 9. The larva of *Cuterebra beameri* Hall ready to go into the soil.

mothers, but no cuterebrids were found. Not yet convinced, Beamer, Hibbard, Leonard, and Jack Beamer visited the type locality on September 27th. Fifty rat nests were examined from which forty-five rats were taken, five of which had six cuterebrid larvae. Many of these, including the infested ones, were brought back to Lawrence and caged. The first larvae emerged on October 10th and the last came out on October 14th. At this writing, March 15, 1943, none of the adult flies had appeared.

The cleanliness of the wounds and of the area about the wounds in the pack rats caused by these huge larvae was remarkable. The warbles never seemed to bother the rats at any time. The only evidence one had that the rats were aware of their parasites was infrequent scratchings of the area with the hind feet. Immediately after a larva had emerged there was quite a large, sometimes bloody, hole in evidence but the rapidity with which these holes closed and completely healed was astonishing. Usually within four or five days practically all signs of the rather terrible wound had disappeared.

SUMMARY

1. There is a species of Cuterebridae (*Cuterebra beameri* Hall)¹ infesting pack rats (*Neotoma floridana osagensis* Blair) in Kansas.
2. From one to five larvae have been found in one rat.
3. This cuterebrid lays its eggs at random in and over the entrance to the rat nests.
4. The rapidity with which the wounds, caused by the larvae in the rats, heal is remarkable.
5. There are two generations of this fly a year.

1. Proc. Ent. Soc. of Washington, Vol. 45, No. 1, Jan. 1943, p. 25.

STUDIES IN PHYLLOMYDAS (MYDAIDAE-DIPTERA)

D. ELMO HARDY, Lawrence, Kansas*

The Mydaiidae belonging in the genus *Phyllomydas*, as characterized by this writer, have no developed palpi; the spur of each hind tibia is straight and shorter than the apical spines and equal or less than the width of the basitarsus. The antennae of the sexes are dissimilar, in the male the apical portion is much more elongate and flattened than in the female; the mesonotum with hairs on posterior margin; the females have no circlet of spines at the apex of abdomen; the front is broad and flat and the vertex is only slightly concave, only sunken below eye margin behind ocelli.

*Contribution from Department of Entomology, University of Kansas.

Key to Species Based upon Males

1. Entirely dark colored species, chiefly metallic black or brownish
Phyllocerus Bigot
 Abdomen at least with yellow to rufous bands on apices of segments ----- 2
2. Abdomen entirely light colored ----- 3
 Only apices of segments yellow, otherwise dark reddish brown; wings hyaline except along costal margin
 ----- *scitulus* (Williston)
3. Thorax and legs entirely black, pile of head and thorax black ----- *currani* n. sp.
 Legs, scutellum, metanotum, pleurae and sides of mesonotum yellow-brown, pile of head and thorax yellow
 ----- *bruesii* Johnson

Phyllomydas bruesii Johnson

Phyllomydas bruesii Johnson, 1926, Proc. Bost. Soc. Nat. Hist., 38, 140.

This species is related to *P. phyllocerus* Bigot and they are rather similar structurally, however the genital characters are very distinctive. The clasping structures are very blunt, evenly rounding on the sides and the cleft of coxopodite is broadly 'v' shaped. The antennae are slightly different in shape in the two species and the yellow-red abdomen and legs and yellow pile of *P. bruesii* will distinguish it.

Length 17 mm.

The females of *P. bruesii* Johnson and *P. phyllocerus* Bigot are difficult to distinguish unless accompanied by males.

Type locality: Galveston, Texas. Type in Cambridge Museum of Comparative Zoology.

Topotypic specimens are in the Snow Collection, May (F. H. Snow) also specimens from Arkansas Co., Texas, 8-6-28 (R. H. Beamer, L. D. Beamer and A. M. James) and Cameron Co., Texas, 8-3-28 (R. H. Beamer, A. M. James).

Phyllomydas currani n. sp.

This species is related to *P. bruesii* Johnson and is distinguished by having the thorax and legs entirely black, pile of head and thorax black, wings dark brown fumose and fourth antennal segment about equal to length of first three.

Male.—**Head:** Entirely black, covered with dense black pile. Face strongly gibbose and thickly haired. Front broad and rather flat with transverse ridge extending across the upper portion in line with upper ocelli. Vertex gently concave, sloped gradually from the eye height. Fourth antennal segment densely brown pollinose, slightly enlarged at base and tapering toward apex, this segment

has a distinct transverse depressed area at its middle; segments one to three about equal in length to fourth. **Thorax:** Subshining black in ground color, the dorsum is finely rugulose, giving it a subopaque, faintly grayish appearance. Pile of dorsum rather sparse, more dense on anterior lateral margins. Mesopleurae with numerous hairs on posterior and anterior margins. **Legs:** entirely black. Posterior trochanters with only fine hairs below. Hind femora thickened toward apical portion, femoral spines strong. Posterior tibia straight or nearly so, apical spur well developed but shorter than the terminal bristles. Tarsal subsegments rather thick, first one and one-fourth longer than second. Halteres black. Squamae with a dense fringe of long black pile. **Wings:** Rather dark brown fumose, apex and the median portion of cells R_4 and R_5 almost hyaline. **Abdomen:** Dorsum entirely yellow red, except for brownish black genital portion. Venter chiefly yellow, margins of segments faintly brownish.

Length: body (not including antennae) 17 mm.; wings 12 mm.

Holotype male, Douglas, Arizona (W. W. Jones).

Length: body (not including antennae) 17 mm. Wings 12 mm.

Holotype male, Douglas, Arizona (W. W. Jones).

Female unknown.

Type returned to Dr. C. H. Curran, American Museum of Natural History.

Phyllomydas phyllocerus Bigot

Phyllomydas phyllocerus Bigot, 1880, Bull. Soc. Ento. France.

As stated above this species is related to *P. bruesii* Johnson, the metallic black body and legs, black pile and distinctive genitalia readily separate it. The clasping structures are rather acutely pointed on inner apices and the cleft on the posterior median margin of the coxopodite is 'U' shaped.

Length 18-20 mm.

Females are difficult to distinguish from *P. Bruesii* unless accompanied by males.

Type locality, Rocky Mountains.

This species is rather common and widely distributed over the central states and west.

Phyllomydas scitulus (Williston)

Mydas scitulus Williston, 1886, Trans. Amer. Ent. Soc., XIII; 291.

This species is distinguished by the broad bands of yellow on apices of the abdominal segments and by the chiefly hyaline wings, with only the costal margin brownish.

Length: 14-15 mm.

Type male, Arizona. In Snow Collection.

A NOTE ON THE RANGE OF *MESOVELIA CRYPTO- PHILA* HUNGERFORD (HEMIPTERA: MESOVELIIDAE)

HALBERT M. HARRIS, Ames, Iowa

In 1924 Doctor H. B. Hungerford described *Mesovelia cryptophila*, the second of two new species of Mesoveliidae that he had found frequenting a particular bog habitat in the vicinity of Douglas Lake, Michigan (Ann. Ent. Soc. Amer., 17: 453-455, 1926). Some eight years later, Clarence E. Hoffman reviewed the biology of the species found at Douglas Lake, and considered that the known distribution of *cryptophila* was limited to that one bog (Can. Ent. 64:113-120, 1932). Previous to Hoffman's work, however, the writer had found a few specimens of this species in some miscellaneous aquatic material taken at Wapello, Iowa, in 1926, and at McComb, Mississippi in 1924, and its occurrence at these localities had been recorded in a joint paper with Dr. Carl Drake on the general distribution of some North American water striders (Ohio Journal Sci., 28:274, 1928). Sixteen years passed during which much miscellaneous collecting was done both in Iowa and Mississippi without the discovery of another specimen. It was with considerable resolve, therefore, that I set out this past summer to find this form when occasion to collect in eastern Iowa presented itself.

As luck had it, I was not forced to seek out the site of my original collecting at Wapello, for on my first try, August 11, I found the species on the stagnant backwater of a stream about five miles south of the city of Clinton. Specimens were rare there in comparison to the numbers of individuals of *M. mulsanti* White one took in the net. Much work was necessary to get a dozen individuals and I seemed to get them only in shady spots around the base of a few small trees standing in the water. Each dredging with the net brought in scores of *M. mulsanti*, *Microvelia borealis* T. B., *Rheumatobates rileyi* Bergr., *Hydrometra martini* Kirk., and other aquatic forms and the small size, the dark color, and the alacrity of their movement, particularly of the slender male individuals, made it difficult to capture *M. cryptophila*.

On September 10 while collecting around a small pond near Bedford in southwestern Iowa, I was greatly surprised, and pleasantly so, to find *M. cryptophila* again. I had been at the pond a good hour and had collected almost completely around its borders without a thought of *M. cryptophila* when the urge came to me to try my net along some logs floating out from the bank. As I retrieved my net I was amazed to see the characteristic *M. cryptophila* dashing for

the rim. Collecting along the shady side of the log and in the shady angles between adjacent logs soon yielded a nice series of individuals, this time in company with *M. mulsanti* White, *Hydrometra marini* Kirkaldy, and *Microvelia hinei* Drake. Thus it appears that *Mesovelia cryptophila* Hungerford has a fairly wide range, and that greater attention to secluded and shady spots with more careful observation of the minute and agile forms that hurriedly scamper from the net may yield it elsewhere. All individuals taken were apterous.

NOTES AND DESCRIPTIONS OF SOME SPECIES OF DIKRANEURA (HOMOPTERA AIADELBDÆ)

R. H. BEAMER, Lawrence, Kansas

This paper is a result of working up the undetermined *Dikraneura* in the Snow Entomological Collection, University of Kansas. Four old species are included and twelve described as new. A majority of the new ones have been considered *D. kunzei* in the past. Thanks are due Colorado State College for the loan of types of *D. kunzei* and *D. rufula* and to P. W. Oman of the United States National Museum for the comparison of material with the type of *D. lenta* McA.

All types of new species are in the Snow Entomological Collection, University of Kansas, Lawrence, Kansas.

1. *Dikraneura rufula* Gill.

Dikraneura abnormis var. *rufula*, Gillette, C. P., Proc. U. S. Nat. Museum XX, p. 720, 1898.

Genitalia: Male aedeagus in lateral view bent dorsally at almost right angles near base; ventral margin with sharp shoulder near outer third ending in a sharp point which protrudes toward apex of ventrally curving bifid process which arises from apex of dorsal margin. A pair of curved processes near middle of shaft on dorsal margin with a shorter retrorse sharp spine just anterior to these and on same margin.

Since the female type was supposed to be in the U. S. National Museum and is apparently lost, two specimens without abdomens from the Colorado State collection were studied. One of them from Placer Co., California, is probably the mutilated specimen referred to in the original description, and since the specimen described and figured here agrees with it in shape of head and coloring, this ♂ from Dunsmuir, California, June 29, 1935, R. H. Beamer, is here designated *neotype*.

*Contribution from Department of Entomology, University of Kansas.

2. *Dikraneura ungulata* Beamer, n. sp.

Resembling *D. rufula* Gill. but much larger (3.5 mm. to 4.5) with ventral apical process of aedeagus very long and slender and lateral processes near base of shaft at about its middle in lateral view.

Length ♂ 4.5 mm.

Vertex quite sharp, margins arcuate; pronotum almost as long as wide; elytra long.

Color: Greenish yellow to semihyaline, one specimen with a reddish tinge.

Genitalia: Male plates about three times as long as width at base, roundly tapered on outer half to sharp apices. Pygofer long, narrowed on outer half into a long, sharp, dorsally projecting spine. Aedeagus in lateral view bent at right angles near base, widest just beyond bend with a pair of curved lateral processes near middle of this wide region, shaft almost parallel to outer fourth where it divides into a single, long, slender, ventral process and a longer dorsal one which is divided about half its length and curves ventrally around the apex of the single one.

Holotype ♂ Santa Rita Mts., Arizona, Aug. 18, 1935, E. I. Beamer. Allotype ♀ and ♀ paratype same time and place. R. H. Beamer.

3. *Dikraneura retusa* Beamer, n. sp.

Resembling *D. rufula* Gill., but vertex quite distinctly blunted and aedeagus with pair of curved processes on ventral margin of shaft near apical offset and just a coarse bump on dorsal margin near middle.

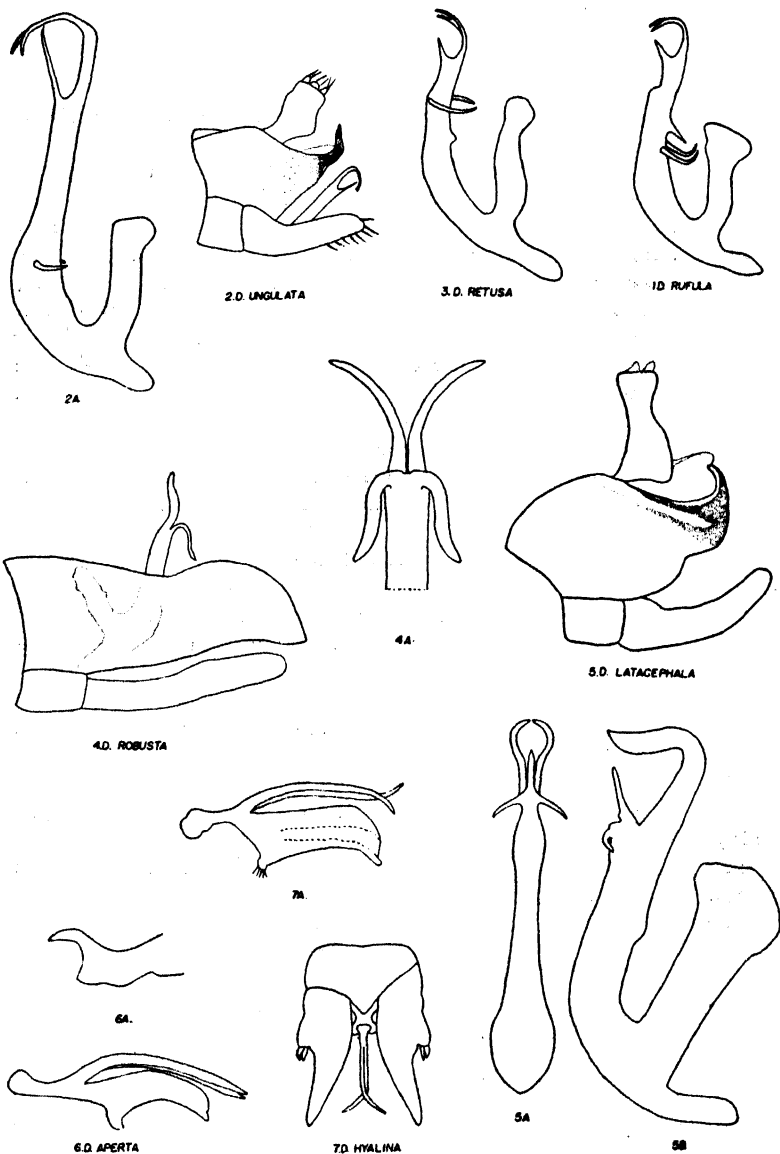
Length ♂ 3.5 mm.

Vertex distinctly blunter than average specimen of *D. rufula*, forming almost a right angle.

Color: Reddish except eyes, a thin longitudinal line on vertex, anterior margin of pronotum and scutellum yellowish, cells in elytra semihyaline, and costal plaque whitish. The females do not seem to be quite so heavily marked with red as do the males. Yellowish green seems to take the place of red.

Genitalia: Plates slightly more than twice as long as basal width, tapering almost from base to apex, about one-fourth as wide as base, rounded. Pygofer narrowed on outer half into a long dorsally curving spine. Aedeagus in lateral view bent at about right angles near base, pair of processes curving dorsally on ventral margin near the outer third, shaft narrowing from here to end in a sharp spine projecting toward apex of a bifurcate process coming off the dorsal margin, this margin with a blunt tooth near the middle.

Holotype ♂; allotype ♀; and one ♂ and nine ♀ paratypes, Stinson Beach, Calif., Aug. 15, 1938, R. H. Beamer. Other paratypes: 22 ♂s and 25 ♀s, Monterey, Calif., July 22, 1935, R. H. Beamer; 3 ♂s



Mt. Tamalpais, Calif., August 15, 1938, R. H. Beamer.

4. *Dikraneura robusta* Lawson

D. robusta Lawson, P. B., Canadian Ent., 1930, February, Vol. LXII.

Genitalia: Last ventral segment of female twice as long as preceding; lateral angles broadly rounded; posterior margin shallowly excavated on median third. Male valve broader than base of plates apically rounded. Plates long and narrow; laterally flattened on outer third, fitting the sides of apex of pygofer; pygofer exceptionally long, outwardly avicephaliform, ventral outer margin pointed out, protruding between and below the apex of the plates. Aedeagus in lateral view with shaft bent dorsally. Apex with a pair of retrorse processes slightly longer than width of shaft, arising on ventral margin; another pair of longer processes arising on dorsal margin projecting up and out.

Allotype ♀ and numerous ♀ paratypes, Chama, N. Mex., July 5, 1937, C. L. Johnston.

5. *Dikraneura latacephala* Beamer, n. sp.

Resembling *D. robusta* Lawson but pygofer truncate at tip and aedeagus in lateral view with 5 processes at apex instead of 4.

Length 3 mm.

Head wider than pronotum; general color milky white, tinged with ivory on the vertex.

Genitalia: Last ventral segment of the female about two and one-half times as long as preceding, lateral angles broadly rounded, posterior margin slightly produced at middle third. Male pygofer more or less truncate at the apex, dorsal outer corner produced into a broad curving process. Aedeagus in dorso-ventral view swollen at the base narrowing to a small enlargement just before apex, with 5 apical processes; in lateral view more or less U-shaped, slightly more than 6 times as broad as long, dorsal margin ending in a pair of broad recurved processes; ventral margin ending in a sharp slender spine with a pair of slender retrorse processes at its base.

Holotype ♂, allotype ♀ and 13 female paratypes, Creede, Colo-

PLATE I.

Fig. 1. Lateral view of aedeagus *Dikraneura rufula* Gill.

Fig. 2. Lateral view of tip of abdomen of ♂ *Dikraneura unguolata* n. sp.

2a. Lateral view of aedeagus.

Fig. 3. Lateral view of aedeagus *Dikraneura retusa* n. sp.

Fig. 4. Lateral view of tip of abdomen *Dikraneura robusta* Lawson.

4a. Ventral view of tip of aedeagus.

Fig. 5. Lateral view of tip of abdomen of ♂ *Dikraneura latacephala* n. sp.

5a. Ventral view of aedeagus.

5b. Lateral view of aedeagus.

Fig. 6. Lateral view of aedeagus of *Dikraneura aperta* n. sp.

6a. Apex of style.

Fig. 7. Ventral view of apex of abdomen of *Dikraneura hyalina* n. sp.

7a. Lateral view of aedeagus.

rado, July 6, 1937, 3♂ and 13 ♀ paratypes, Pagosa Springs, Colorado, July 5, 1937, R. H. Beamer.

6. *Dikraneura aperta* Beamer, n. sp.

Resembling *D. rubens* Beamer in internal genitalia, but without bright orange-red markings of dorsum, and processes of aedeagus not crossing at their base.

Length 3 mm.

Color: Stramineous to semihyaline. Vertex with a semblance of two darker comma spots on disc. Pronotum with an indication of a pair of golden yellow diverging spots near middle in some specimens. Elytra semihyaline, usually tinged with yellow in form of oblique vittae with a small dark spot at tip of clavus. Areas about crossveins more or less fumose.

Genitalia: Last ventral segment of female about twice that of preceding, lateral angles broadly rounded, posterior margin almost straight. Valve of male triangular; plates as broad at base as valve, suddenly narrowed on outer margin near middle with strong spine on this shoulder, outer third not more than half as wide as base. Aedeagus in lateral view with shaft about twice as long as basal width, apex slightly hooked dorsally with pair of long slender processes arising ventrally at base of shaft, reaching slightly beyond apex.

Holotype ♂, allotype ♂; 2 ♂ and 6 ♀ paratypes, Stinson Beach, Calif., August 15, 1938, R. H. Beamer.

7. *Dikraneura hyaline* Beamer, n. sp.

Resembling *D. readionis* Lawson but vertex, pronotum and scutellum golden yellow instead of stramineous; shaft of aedeagus in lateral view broad, about three times as long as wide, and almost as long as two ventral processes.

Length 3.5 mm.

Color: Semihyaline tinged with golden yellow, with a small fuscous spot on apex of clavus and some darker areas in region of cross veins.

Genitalia: Last ventral segment of female about twice as long as preceding, posterior margin roundly produced. Male plates broad on basal half, abruptly narrowed on outer margin forming a shoulder with two blunt teeth. Aedeagus in lateral view broad, about three times as long as wide, apex slightly curved dorsally; ventral margin with a pair of narrow processes arising at base, extending parallel with shaft, crossing each other near tip, and ending slightly beyond apex of shaft.

Holotype ♂, allotype ♀, and 4 ♂ paratypes, Siskiyou National Forest, Calif., July 14, 1935; R. H. Beamer.

8. *Dikraneura kunzei* Gill.

Dikraneura kunzei Gillette, C. P., Proc. U. S. National Museum, XX, p. 721, 1898.

Male plates scarcely three times as long as width at base, rapidly narrowed on outer half to about one third basal width, apex rounded. Pygofer with a heavy brown spine on dorsal outer corner. Aedeagus broad in lateral view, bent at right angles dorsally near base; in dorsoventral view almost one-third as wide as long, gradually tapering to slender tip. In cross-section shaft is V-shaped with opening of V posterodorsal, this opening occupied by a slender process, usually exposed on about apical third and ending short of apex of shaft.

Two ♂ and one ♀ cotypes examined through the courtesy of Doctor James, Colorado State College, Ft. Collins, Colorado. The male with No. 2089 is here designated Lectotype. Taken by R. E. Kunze, Tuscon, Arizona, April 11-14, 1896, sweeping weeds, grass, alfalfa, etc.

This species is commonly collected on mesquite and related plants.

9. *Dikraneura lenta* McA.

Dikraneura kunzei var. *lenta* McAtee, W. L., Jour. N. Y. Ent. Soc. p. 160, 1926.

Resembling *kunzei* but with usually blunter head and process of aedeagus as long as or longer than shaft.

Genitalia: Aedeagus longer than in *kunzei* and narrower in both lateral and dorsal view, with one median process as long as or longer than shaft.

A specimen studied from Alpine, Texas, compared with type in U. S. National Museum by P. W. Oman.

This species has the same general type of aedeagus as *D. kunzei* but with the differences as stated. Twenty-three males were dissected and studied.

10. *Dikraneura benedicti* Beamer, n. sp.

Resembling *D. kunzei* Gill., but aedeagus cylindrical with processes on side.

Length 2.75 mm.

Color: Vertex, anterior margin of pronotum and scutellum ivory with golden yellow flecks, basal angles of scutellum and apex solid golden yellow; disc of pronotum more semihyaline. Elytra greenish semihyaline.

Genitalia: Plates of male about three times as long as basal width, outer margin roundly narrowed near middle to about half basal width, apex rounded. Pygofer with a short tooth on outer dorsal corner. Aedeagus long and slender in lateral view, sickle-shaped, widest at base, almost parallel-sided on outer three-fourths, with a pair of lateral processes diverging laterally from shaft on outer third.

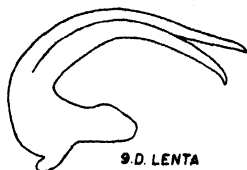
Holotype ♂ and 8 ♂ paratypes, Jeff Davis Co., Texas, July 8, 1933, W. Benedict.



8.D. KUNZEI



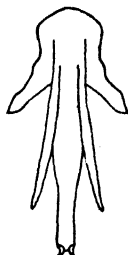
8A



9.D. LENTA



11A.



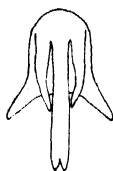
10A.



10.D. BENEDICTI



11.D. TEXANA



12A



12.D. TENERA



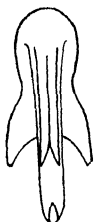
14.D. MUNDA



13.D. FURCATA



13A.



14A



15A



15.D. SALICIS



16A



16B



16D. BISAGITATA

11. *Dikraneura texana* Beamer, n. sp.

Resembling *D. benedicti*, but with aedeagus in lateral view with a dorsally bent tip and processes on dorsal margin of shaft with apices bent dorsally on outer third.

Length ♂ 3 mm.

Color: Vertex, pronotum and scutellum ivory, often flecked with golden yellow or orange. Disc of pronotum more or less semihyaline. Elytra greenish semihyaline tinged with yellow.

Genitalia: Plates of male about three times as long as basal width, slightly wider just out from base, then roundly narrowed to about half basal width, apices rounded. Pygofer about as in *D. benedicti*; hook on outer dorsal corner slightly larger. Aedeagus in lateral view bent dorsally at right angles near base and again near tip; about twice as wide at first bend as at second, with pair of dorsal processes diverging and bending dorsally on outer third, ending near outer fourth of shaft.

Holotype ♂, allotype ♀, and three ♂ paratypes; Ft. Stockton, Texas, July 1, 1936, R. H. Beamer.

Other paratypes: 1 ♂ and 1 ♀, Davis Mts., Texas, July 12, 1938, R. H. Beamer. Two ♂s, Jeff Davis Co., Texas, July 8, 1933, W. Benedict; 3 ♂s, Valentine, Texas, July 13, 1938, R. H. Beamer.

12. *Dikraneura tenera* Beamer, n. sp.

Resembling *D. texana* but aedeagus, with lateral processes apparently at sides of shaft and tip of shaft in lateral view, sharp rather than rounded.

Color: Vertex, anterior margin of pronotum and scutellum ivory, mottled with golden yellow; remainder of pronotum and elytra yellowish green, more or less pruinose.

PLATE II.

Fig. 8. Lateral view of aedeagus of *Dikraneura kunzei* Gill

8a. Ventral view of aedeagus.

Fig. 9. Lateral view of aedeagus of *Dikraneura lenta* McA.

Fig. 10. Lateral view of aedeagus of *Dikraneura benedicti* n. sp.

10a. Ventral view of aedeagus.

Fig. 11. Lateral view of aedeagus of *Dikraneura texana* n. sp.

11a. Ventral view of aedeagus.

Fig. 12. Lateral view of aedeagus of *Dikraneura tenera* n. sp.

12a. Ventral view of aedeagus.

Fig. 13. Lateral view of aedeagus of *Dikraneura furcata* n. sp.

13a. Ventral view of aedeagus.

Fig. 14. Lateral view of aedeagus of *Dikraneura munda* n. sp.

14a. Ventral view of aedeagus.

Fig. 15. Lateral view of aedeagus of *Dikraneura salicis* n. sp.

15a. Ventral view of aedeagus.

Fig. 16. Lateral view of tip of abdomen of ♂ *Dikraneura bisagittata* n. sp.

16a. Ventral view of aedeagus.

16b. Lateral view of aedeagus.

Genitalia: Male plates and pygofer about as in *kunzei*, aedeagus in dorsoventral view with shaft narrow, almost parallel-sided to rounded apex, with a pair of lateral processes slightly more than half as long as shaft; in lateral view shaft bent dorsally near base, narrowing gradually to another dorsal bend near sharp apex; processes in this view stand away from shaft with sharp apices.

Holotype ♂, allotype ♀, 4 ♂ and 4 ♀ paratypes. Arivaca, Arizona, July 26, 1941, R. H. Beamer.

13. *Dikraneura furcata* Beamer, n. sp.

Resembling *D. texana*, but processes of aedeagus apparently joined together on basal two thirds, then bifurcate on apical third.

Length ♂ 2.25 mm.

Color: More nearly golden yellow than other species of this group with lighter flecks on vertex, pronotum and scutellum. Elytra semihyaline washed with yellowish green.

Genitalia: Male plates about three times as long as basal width, slightly enlarged just out from base, roundly narrowed to half basal width on outer third, tip rounded, pygofer with rather heavy hook on dorsal outer corner. Aedeagus in lateral view bent dorsally at right angles near base, gently curving dorsally to tip; in dorsal view processes apparently united on basal two thirds, each process excavated near apex on outer margin.

Holotype ♂, allotype ♀, 4 ♂ and 5 ♀ paratypes; Three Rivers, Texas, June 27, 1938, R. H. Beamer. Other paratypes: 1 ♂ and 2 ♀, Brownsville, Texas, June 26, 1938; 1 ♂ College Station, Texas, June 23, 1938; 1 ♂, Concan, Texas, July 6, 1936.

14. *Dikraneura munda* Beamer, n. sp.

Resembling *tenera* but coloring of vertex, anterior margin of pronotum and scutellum solid yellow, not mottled; processes of aedeagus on ventral side of shaft and tip of shaft in lateral view rounded.

Length: 3 mm.

Vertex slightly less than right angle from eye to eye; length at middle about equal to width between eyes.

Color: Face, vertex, anterior margin of pronotum and scutellum golden yellow, segments of abdomen dark except last ventral and pygofer of female which are light. Elytra semihyaline, washed with yellowish green more or less pruinose.

Genitalia: Last ventral segment of female several times as long as preceding; posterior margin with lateral angles broadly rounded and median fourth roundly produced. Aedeagus in dorsoventral view with shaft of medium width, sides almost parallel to rounded apex with pair of processes on ventral side, slightly diverging at tips, extending about two-thirds distance to tip of shaft; in lateral view shaft bent dorsally at base and again near apex, processes close

to shaft except diverging from it at their apices.

Holotype ♂, allotype ♀, 4 ♂ and 11 ♀ paratypes; Indio, Calif., December 22, 1941, R. H. Beamer.

Swept from mesquite.

15. *Dikraneura salicis* Beamer, n. sp.

Resembling *D. kunzei* but aedeagus with two short lateral processes near apex of shaft.

Length 2.25 mm.

Color: Vertex, scutellum and anterior margin of pronotum ivory with orange marks; remainder semihyaline, tinged with yellowish green. Vertex with orange line either side of margin connected before apex, crown with five or six more or less parallel ivory longitudinal lines, remainder orange. Narrow anterior margin of pronotum with a semblance of nine ivory longitudinal lines. Scutellum with basal angles, circle at apex and two median parallel lines orange.

Genitalia: Last ventral segment of female about three times as long as preceding, lateral angles broadly rounded, posterior margin produced throughout, more pronounced at middle. Aedeagus of male in dorso ventral view broad about as wide near base of processes as one fourth length of shaft, with pair of lateral processes arising about width of shaft from its apex, rather broad and heavy.

Holotype ♂, allotype ♀, 2 ♂ and 8 ♀ paratypes; Ruby, Ariz., July 22, 1938, R. H. Beamer. Swept from *Salix taxifolia* H. B. K.

16. *Dikraneura bisagittata* Beamer, n. sp.

Resembling *D. kunzei* Gill., but entirely golden yellow, and aedeagus with two pairs of sagittal processes.

Length: 2.5 mm.

Color: Golden yellow with head, pronotum and scutellum usually darker.

Genitalia. Last ventral segment of female more than twice as long as preceding, lateral margins with outer angle broadly rounded, posterior margin definitely produced medianly, broadly excavated either side of middle. Pygofer with a long slender spine arising on dorsal margin near base of anal tube, about half as long as width of pygofer. Aedeagus broad in lateral view, at middle about one third as wide as length; shaft with two pairs of short processes, one pair at apex about middle of side, and one pair on ventral margin near middle of shaft, all processes slightly longer than width of shaft in dorsoventral view.

Holotype ♂, allotype ♀, 14 ♂ and 56 ♀ paratypes; Estero, Fla., July 21, 1934, R. H. Beamer. Numerous paratypes from Bonita Springs, Florida, July 21, 1930; R. H. Beamer; and Likely, Fla.; August 7, 1930 and July 24, 1934, R. H. Beamer.

A CONTRIBUTION TO THE TAXONOMY OF THE GENUS ORGERIUS IN AMERICA, NORTH OF MEXICO (FULGORIDAE, HOMOPTERA)

KATHLEEN C. DOERING and HERBERT H. DARBY, Lawrence, Kansas*

Abstract

This paper involves a comprehensive study of the genus *Orgerius* in America, North of Mexico. To the two older species, *O. rhyparus* Stal 1859 and *O. minor* Ball 1909, have been added the following nine new species: *proprius*, *triquestrus*, *bucculentus*, *bilobatus*, *junceus*, *spicatus*, *disgregus*, *bicornis*, and *foliatus*. Three of the varietal forms of Ball and Hartzell (1922) have been raised to specific rank; namely, *pajaronius*, *concordus* and *ventosus*. *Orgerius rhyparus* var. *clitellus* (Ball and Hartzell, 1922) is not recognized even as a color variety since this same coloring is occasionally found in four other species. Dissections of the male genitalia were made and the structures figured. Other comparative structural drawings are included. The structures of most value in the classification of the group are lateral lobes of the ninth abdominal segment in the male, length and shape of the vertex and the male genitalia.

DESCRIPTION OF SUBFAMILY DICTYOPHORINAE

Head narrower than the mesonotum. Vertex produced in front of the eyes a definite fractional part of its length depending on the species, apex truncate or slightly conical. Frons with median carina and apex without ocelli, border of face always sharp or with a keel. Lateral margins of pronotum equalling its median length. Wings macropterous, many brachyterous, no transverse veins along costal border or no distinct cross veins from costal margin to apex of clavus. Anterior femora normal. Posterior tibia without a movable spur.

DESCRIPTION OF THE TRIBE ORGERIINI

The ocelli are completely absent, the face has lamellate, careened borders. its length is greater than the basic width, and a distinct carina passes through its middle. The upper wings are very short. Clavus and corium are not distinguishable. As viewed from the side the pronotum shows two well pronounced, closely adjacent carinae; the upper one of which serves as a border of the dorsal surface, but the lower one is not far below it, after which the pronotum is reflexed into a broad ventral flap. Tegulae not noticeable. The upper wings short and not reaching one-half of the abdomen. They cover the upper side of the body, but turn vertically down on the sides near the base forming a fairly broad and smooth flap, tapering toward the middle of wing. A distinct longitudinal

*Contribution from Department of Entomology, University of Kansas.

mesal carina runs lengthwise of the dorsal surface of the abdomen and lateral of this on the sides of the abdomen not far from the border a more indistinct carina is usually seen. On the side of each abdominal segment not covered by the tegmina just back of middle is a transverse row of pits. Body always bare, only the trunk, the feet and one-half of the appendages are covered with fine hairs.

KEY TO NORTH AMERICAN GENERA OF ORGERIINI

(Based on key of Ball and Hartzell, Annals Ent. Soc. of Amer., 1922)

1. Callosity behind eye; vertex elongate or angulate 2
 No callosity behind eye; vertex rounding or if elongate
 broad if seen from side 5
2. (1) Vertex elongate, with more than one-half its length
 beyond the eyes 3
 Vertex angulate, narrowing from the eyes, less than
 twice the length of the eyes **Orgerius** Stal.
3. (2) Cephalic process truncate at the extremity, five angled ---- 4
 Cephalic process as seen from side, beak-like, the
 apex obliquely rounding from above, the lower angle
 slightly produced **Deserta** Ball
4. (3) Cephalic process gradually tapering as seen from top
 and side **Orgamara** Ball
 Cephalic process parallel margined; apex as seen
 from the side slightly enlarged, projecting at an angle
 with the vertex **Yucanda**, Ball and Hartzell
5. (1) Vertex angulate, produced in front of the eyes at
 least one-third its length 6
 Vertex broad and short, scarcely longer than its basal
 width; the lateral carinae of front closely margins
 the eye up to its juncture with the lateral margin of
 vertex 7
6. (5) Head twice the length of the eye as seen from the side
 widening toward the apex **Acinaca** Ball and Hartzell
 Eyes contiguous to pronotum, head distinctly less than
 twice the length of the eyes, as seen from the side,
 distinctly narrowing and roundly truncate
 **Aridia** Ball and Hartzell
7. (6) Fore and middle tibia broadly foliaceous ---- **Timodema** Ball
 Tibia normal 8
8. (7) Lateral carinae of the frontal tablet uniting some
 distance below the apex of the head **Ticidia** Uhl
 Lateral carinae of the frontal tablet narrowing but not
 uniting before joining the vertex .. **Timonidia** Ball and Hartzell

ORIGINAL DESCRIPTION OF THE GENUS ORGERIUS Stal 1859

Stahl, Carolus, Freg. Eugens. Resa, Omkring; Jorden; 1851-1859

Cephalic process short, broad at the base, tapering to an angular or slightly conical point, not truncate. The lateral carinae of the front rounding into median carina at the apex of the cephalic process. Oblique carina curving upwards from the eye, pustulate below; median carina extending to the apex. Eye separated from the pronotum by a diamond-shaped callosity. The anterior margin of the lateral tablets of pronotum transverse instead of inclined posteriorly. Carinae of scutellum sharply defined. Elytra brachypterous, irregularly reticulate. Abdomen obese, oval. Rostrum equalling the abdomen or slightly beyond. Anterior femora expanded three times the width of the tibia; post tibia flattened, inclined to be serrate, the serrations crowned with six to eight black spines.

KEY TO SPECIES OF GENUS ORGERIUS

1. Hind tibia distinctly flattened basally, the heavy spines appearing as serrations; lateral margins of vertex moderately or slightly elevated; lateral shoulders of pronotum elongate, their width greater than the central disk ----- rhyparus group ----2
Hind tibia not modified; lateral margins of vertex conspicuously elevated; lateral shoulder of pronotum abbreviated, narrower or only equal to width of central disk ----- minor group ---- 13
2. (1) Vertex extended beyond eye a distance greater than half length of vertex; tegmina with reticulation indistinct ----- 3
Vertex extended beyond eye not over one-half the vertex length; reticulation of tegmina distinct (except in *spicatus*) ----- 4
3. (2) Vertex with lateral margins gradually narrowing, its length extended beyond eye one-fifth longer than portion between eyes, its apex about one-third of its basal width ----- *proprius* n. sp.
Vertex with lateral margins abruptly constricted beyond eyes, extended in front of eye less than above, its apex about one-fifth of its basal width -- *triquestrus* n. sp.
4. (2) Vertex broad, short, length only a little longer than width, extended beyond eye distinctly less than half of its length, lateral margins scarcely elevated ----- 5
Vertex extended beyond eye approximately one-half or more than its greatest length; lateral margins elevated ---- 7
5. (4) Vertex narrowed at apex, width at apex about one-fifth of base ----- *pajaronius* Ball and Hartzell

- Vertex not as acutely narrowed, apical width more than one-fifth of base ----- 6
6. (5) Apex width one-fourth of base; pronotum not deeply concave behind eye, lateral margins gradually sloping, lateral shoulder equal to width of median disk
----- **bucculentus** n. sp.
- Apex width one-third or more of base, pronotum deeply concave behind eye, lateral margins angulate, lateral shoulder wider than disk between carinae ---- **bilobatus** n. sp.
7. (4) Vertex slender, extended in front of eye a distance equal to three-fifths of its length ----- **junceus** n. sp.
- Vertex short, extended in front of eye approximately one-half of total length ----- 8
8. (7) A large slender species, vertex width a little over half its length, basal lateral margins sub-parallel -----
----- **concordus** Ball and Hartzell
- Smaller, obese species, vertex heart-shaped, wider and with lateral margins outwardly curved ----- 9
9. (8) Vertex more acutely narrowed, its width at apex one-fourth of basal width ----- **rhyparus** Stal
- Vertex broader, tip not narrowed, its apical width one-third of basal width ----- 12
12. (9) Vertex longer, width five-eighths of length, lateral margins somewhat constricted before apex, reticulation of tegmina very indistinct ----- **spicatus** n. sp.
- Vertex broad, width three-fourths of length, lateral margins outwardly rounded, reticulation prominent---
----- **disgregus** n. sp.
13. (1) Lateral margins of vertex foliaceous, either bicornate or constricted before apex; lateral shoulder of pronotum equal or very slightly narrower than central disk---14
- Lateral margins of vertex little if any foliaceous, not constricted or bicornate; lateral shoulder distinctly narrower than central disk ----- 15
14. (3) Vertex heart-shaped, lateral margins outwardly curved forming horns mesad of eye, greatest width four-fifths length; tegmina with longitudinal veins indistinct
----- **bicornis** n. sp.
- Vertex longer than above, acutely pointed, constricted just before apex, greatest width three-fifths length; tegmina with longitudinal veins distinct ----- **foliatus** n. sp.
15. (13) Vertex with apex moderately pointed, greatest width about two-thirds length; tegmina with reticulation very indistinct ----- **ventosus** Ball and Hartzell

Vertex slightly broader than above, greatest width about three-fourths length; tegmina with reticulation distinct ----- minor Ball

***Orgerius rhyparus* Stal 1859**

Original Description

***Orgerius rhyparus* Stal Freg. Eugen. Resa Omkring Jorden 1851-1859**

Dilute fusco-testaceous, maculis margines verticis parvis maculisque obsoletis inter carinas frontis fuscescentibus. Male Long. 5, lat. 3.5 millim. Tab. III p. 199 Magn. Auct; 9 a magn. nat; 9 b caput ab antico visum.

Patria, Cal. (San Francisco)

Author's Description

Size: Length from tip of head to tip of abdomen, male 5.0 mm. to 5.2 mm.; female 5.6 mm. to 6.2 mm. Greatest body width, male 2.8 mm. to 3.2 mm.; female 3.2 mm. to 3.7 mm.

Color: Color variable, a few specimens uniform rufous, the majority testaceous to fuscous with small dark spots. Lateral margins of vertex dotted with larger spots. Frons lighter, speckled uniformly with minute dots. Anteclypeus paler, frequently orange; dots paler or lacking. Postclypeus darker and heavily dotted. Pronotum fuscous with a row of spots around anterior margin; the reflexed ventral flap visible below showing the posterior half pale and without spots, anterior to which is a broad dark band, heavily speckled. Mesonotum fuscous, sometimes lighter than pronotum, uniformly spotted. Tegmina variable, in rufous specimens a reddish-tan, in the darker specimens sometimes deep fuscous, in others with inner half only darker. Abdomen fuscous uniformly speckled. Legs heavily speckled. Tarsi of all legs and spines on hind tibiae black. Tip of rostrum brown.

Structural Details: A median-sized obese species with a heart-shaped vertex, extending one-half of its length beyond eye and its width about five-eighths of its length. Vertex acutely narrowed at tip, parallel-margined or widening only slightly near the base, the lateral margins strongly foliaceous and elevated. Frons moderately long, only about one-fourth longer than greatest width of head across eyes. Tegmina, length and width equal, wing reticulation fine and uniform so that longitudinal veins are inconspicuous. Lateral lobe of ninth abdominal segment of the male, length and width equal, its dorsal margin a straight line terminating in a sharp arc then rounding to meet the eighth abdominal segment, this ventral margin equal in length to length of harpago showing beyond its tip.

Male Genitalia: Anal flap (tenth abdominal segment) narrow at base, the margin diverging to one-fourth distance from base, then running parallel and converging to form a broad, truncate tip. Tip

of stylus knob-like.

Harpago, as viewed from a flattened lateral view ovate with a slender, sharply pointed, cephalad-curving hook at middle of dorsal margin, just cephalad of which is another external hook which curves downward and slightly cephalad.

The aedeagal structure is complex and better understood by studying the diagram. Ventrad the theca is longer and divides apically into four frilled lobes which are shorter than in other species, dorsad the apical margin is bilobed. The only portions of the aedeagus showing are the tips of the long slender aedeagal hooks which become more sclerotized from the point of curving cephalad, while the basal half of the exposed hook is membranous.

Comparative Notes: The genus *Orgerius* in North America seems to fall roughly into three groups of species. The species making up the so-called *rhyparus* group are as follows: *rhyparus*, *junceus*, *concordus*, *pajaronius*, *bucculentus*, *bilobatus* and *disgregus*. The structural differences between these species are not striking for any one character but by summarizing the combined characteristics it is possible to separate them. The size of the vertex varies as follows: in *bucculentus* and *bilobatus* it is shorter than in any of the others, being only a trifle longer than wide and its margins are scarcely elevated; in *junceus* it is the longest, where it is a little greater than twice its width; in *concordus* its width is seven-tenths of its length; in *rhyparus*, *disgregus* and *pajaronius* it can be described as being heart-shaped and of moderate length, with their widths respectively five-eighths, three-fourths and eleven-sixteenths of their lengths. The general shape of the body varies with *bucculentus* being a short, broad and chubby species, *concordus* a large, slender ovate species, *junceus* slender but shorter than *concordus*, and *rhyparus*, *disgregus*, *bilobatus* and *pajaronius* moderately obese. Another character of importance is the lateral lobe of the ninth abdominal segment of the male. In *rhyparus* this lobe is smaller and more pointed than in the others although it is more closely related to *concordus* than the others. But these two species are easily distinguished by the larger size and longer vertex of *concordus*. A study of the diagram will indicate differences in these lateral lobes which are difficult to describe. These seven species also are distinguished by the male genitalia and again the differences are more readily understood by examining the drawings.

Distribution: Type locality of the species, San Francisco, California. One female from this locality was loaned for study by the National Museum and a rufous male specimen from Colfax, California. A series of five females and two males from Pacific, California, one female and two males from Towie, California, are in the Snow Entomological Collection.

Orgerius rhyparus var. clitellus Ball and Hartzell 1922**Original Description**

Resembling var. *rhyparus*, large, obese forms with a testaceous color sharply set off by the shining black elytra. Described from three examples from Santa Margarita, Chico and Colfax, California. This variety was found with the preceding (*rhyparus*) and appears to be a still rarer adaptation to these dry, hot situations.

Comparative Notes: This variety does not seem to be valid in that the same coloring which is supposed to distinguish it has appeared in numerous other species, namely: *bilobatus*, *concordus*, *disgregus*, *bucculentus* and *pajaronius*.

Orgerius proprius n. sp.

Size: Length of body from tip of head to tip of abdomen, male 5.0 mm.; female 5.5 mm. Greatest body width, male 2.6 mm.; female 2.8 mm.

Color: Uniform testaceous with small but conspicuous dark spots. Vertex with two oblong brown spots near base, and with clusters of spots on lateral carinae especially near tip and others evenly scattered over disk. Frons with six light fuscous transverse, uniformly speckled bands, the four posterior ones broad and the two at apex narrower. Postclypeus light orange, tip heavily spotted, anteclypeus with three heavily spotted bands. Anterior area of pronotal flap darkened, heavily spotted, followed by an orange tinted light transverse band, the posterior margin again lightly speckled. Mesonotum evenly speckled. Posterior margin of tegmina with a row of large black spots, cells of tegmina with veins margined with uniform round dots. Abdomen evenly speckled. Legs heavily speckled. Tarsi of all legs brown. Spines on hind tibia black. Tip of rostrum black.

Structural Details: A slender species with a long vertex, less acutely pointed than in *triquestrus* but more acute than in some species. Vertex width a little over half its length, lateral margins moderately elevated, gradually sloping to apex, two depressed oblong spots between eyes. Frons elongate, about one-third longer than width of head across eyes. Tegmina with longitudinal veins and reticulation moderately distinct, cells fairly large. Body slender, its width approximately half the length of the body. Lateral lobe of ninth abdominal segment of male pointed, the dorsal margin convex thru middle then becoming slightly concave, tip a sharp arc and ventral margin slightly concave, the length of the harpago exposed beyond its tip about one-third of the latter. From a dorsal view these lobes are more distinct than in any other species and overlap the anal flap.

Male Genitalia: Anal flap (tenth abdominal segment) narrowed

at base, basal third with lateral margins parallel, then constricted through middle, again diverging through apical fourth, finally rounding to the narrow, round apex.

Harpago, as viewed from a flattened lateral view ovate with a slender, sharply pointed, cephalad-curving hook at middle of dorsal margin, just cephalad of which is a second external recurved hook.

Aedeagus at base a rectangular sclerotized plate, bilobed at base and bearing two large, sclerotized rods which run caudad, each of which terminates in a recurved arm, composed of a large membranous ball-shaped structure, partially covered by the theca, then becoming sclerotized, constricted for a short distance, again bulging slightly before the sharp finely pointed apex. On the dorsal side the posterior margin of the theca is straight. Ventrad the theca is longer and deeply bilobed.

Comparative Notes: This species in color and general body characteristics resembles the *rhyparus* group instead of the *minor* group. Together with *triquestrus* and *spicatus* it forms a small subgroup based on the lobe of the ninth abdominal segment of the male. For comparison of these three species see notes under the description of *triquestrus*.

From the *rhyparus* group *proprius* is distinguished by the much longer vertex with less elevated margins and the less distinct reticulation of the tegmina.

Location of Types and Distribution: Described from male holotype and female allotype, collected by R. H. Beamer from Mint Canyon, California, on July 6, 1933. Two male paratypes same data. One male paratype collected at Lompoc, California, by R. L. Sailer, August 7, 1938. These types are in the Snow Entomological Collection, University of Kansas.

Orgerius triquetrus n. sp.

Size: Length of body from tip of head to tip of abdomen, male 4.6 mm. to 4.9 mm.; female 4.5 to 5.0 mm. Greatest body width, male 2.5 mm. to 2.6 mm.; female 3.0 mm. to 3.5 mm.

Color: Uniform rufous-tan with minute inconspicuous dark spots. Female slightly darker. Vertex with lateral margins outlined with clusters of speckles, the apical two pairs fused into a more pronounced solid spot. Frons cream-colored, speckles scattered or about seven partially speckled narrow bands indicated, these bands more pronounced at base and apex. Postclypeus light orange with faintly oblique lines; carinae and anteclypeus more speckled. Pronotum with carinae and lateral margins outlined with dark spots. Mesonotum somewhat more rufous. Longitudinal veins yellow, cells more or less fuscous with minute faint speckles, cells along posterior

margin brownish-black. Abdomen rufous-tan, a few scattered fuscous speckles, concentrated along posterior margin of the segments. Legs uniform rufous, heavily speckled, tip of spines on hind tibia black. Tarsi of all legs dark brown. Tip of rostrum dark brown.

Structural Details: A small slender species, characterized by a pronounced triangular vertex with apex forming an acute angle. Width of vertex a little more than one-half its length, lateral margins gradually elevated, median carina prominent. Frons elongate, narrower, about one-third longer than width of head across eyes. Tegmina varying from the *rhyparus* group by having thick longitudinal veins with the reticulations between faint, cells indistinct. General contour of body more ovate and slender than in some species, width of abdomen slightly less than one-half total length of body. Lateral lobe of ninth segment of male with length and width subequal, forming a sub-triangular plate with ventral margin at a right angle to body, dorsal margin roundingly curved to meet the ventral one just anterior to apex of anal flap, the length of the harpago showing beyond its tip only one-fourth of the ventral margin.

Male Genitalia: Anal flap (tenth abdominal segment) broad at base, parallel-margined for half its length, then converging suddenly in line with tip of stylus, then broadening before its regularly rounded apex. Stylus elongated, finger-like with roundingly pointed apex.

The harpago widely different from the *rhyparus* group, the ventral margin a smooth rounded curve, the basal half of dorsal margin reflexed, and bearing the two customary hooks, one located at the end of the reflexed margin and the other halfway between, the apices of both directed ventrad, the apical half of dorsal margin deeply arcuated thus narrowing the apical region to half the width at base.

The aedeagus is in the form of a sclerotized basal plate, somewhat U-shaped, the arms of the U curved inwardly, two slender sclerotized rods attached apically. The aedeagal rods hidden for most of their length by the thecal sleeve, the apical portion exposed beyond the thecal margin recurved, the middle region membranous and bulbous, beyond this formed into a sclerotized apex finely bifurcate at tip. On the dorsal side of the theca the apical margin is shallowly scalloped, ending just anterior to the membranous portion of the aedeagus. Ventrad the theca runs farther down terminating in a lobate-shaped curtain with frilled outer margin whose inner margin is split to a point somewhat above the membranous portion of the aedeagus.

(To be concluded in July issue)

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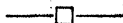
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A CONTRIBUTION TO THE TAXONOMY OF THE GENUS *ORGERIUS* IN AMERICA, NORTH OF MEXICO (FULGORIDAE, HOMOPTERA)

KATHLEEN C. DOERING and HERBERT H. DARBY, Lawrence, Kansas*

(continued from April issue)

Comparative Notes: This species resembles *spicatus* and *proprius* more closely than other species in the genus. These three species can be segregated into a third subgroup if the lateral lobe of the ninth abdominal segment alone is compared since in these species the lobe is distinctly pointed apically, while in the *rhyparus* or *minor* groups it is broadly rounded or truncate. In other characteristics they resemble the *rhyparus* group. The lobe itself in the three species is separated as follows: in *spicatus* the dorsal margin is straight, the apex very acute, and the ventral margin is concave; in *proprius* the dorsal margin is sinuate, broadly convex through middle, apex is likewise acute, and ventral margin slightly concave; in *triquestrus* the dorsal margin is convex, ventral margin straight, the apex less acute and whole lobe shorter than in the other two. *Spicatus* is separated from *triquestrus* and *proprius* by having a shorter vertex, which is extended beyond the eye a distance equal to half its length; in the two latter this distance is greater than half the length and separates these from true *rhyparus* group. *Triquestrus* is distinguished from *proprius* by its more obese body, the vertex more acutely pointed, the reticulation of the tegmina indefinite so that only the longitudinal veins are prominent.

Location of Types and Distribution: Holotype male and allotype female, collected by R. H. Beamer from Orange Co., California, on July 14, 1929. Three female and eight male paratypes same data. One male paratype same collector from Santa Ana County, California, collected on July 30, 1932. These types are in the Snow Entomological Collection at the University of Kansas.

Orgerius pajaronius Ball and Hartzell 1923

as *Orgerius rhyparus* var. *pajaronius* Ball, E. D. and Hartzell, Ann. Ento. Soc. Amer. XV, p. 145, 1923.

Original Description

"Small, rather slender, female not over 4 mm. in length, resembling *concordus* above but much smaller and with the face much more frequently transversely banded with light."

Described from two pairs from Salinas and Watsonville, California. This variety occurs on the Coast Range from the Salinas Valley north to San Francisco and a pair were taken on the eastern slope of the Sierra Nevadas near Le Grande, Oregon.

Author's Description

Size: Length of body from tip of head to tip of abdomen, male

4.2 mm. to 6.0 mm.; female 5.2 mm. to 5.7 mm. Greatest body width, male 2.7 mm. to 3.5 mm.; female 3.2 mm. to 3.5 mm.

Color: Variable in color from rufo-testaceous to much darker, both sexes heavily spotted. Upper surface marked much as in *concordus*, the tegmina with cells darkened, veins of reticulation yellow. Frons yellowish-tan with speckles forming five transverse bands, alternating with lighter bands where spots are few or absent. Post clypeus yellowish-orange at base, a dark brown spot on each side just before apex. Pronotal ventral flap with a conspicuous light yellow wedge on the inner half just back of middle so that it is in line with the lighter area of the postclypeus and forms a striking light band across the body at this point.

Color Variation: Two specimens, a male and a female of the *clitellus* coloration, namely, dark brown tegmina in contrast to a lighter body.

Structural Details: This is one of the smaller species in the genus with the females particularly smaller. Vertex shorter resembling *concordus*, extending beyond eye four-fifths the length of the eye itself, its greatest width approximately eleven-sixteenths of its length and its lateral margins somewhat foliaceous but only slightly elevated. Frons short, about one-fifth longer than width of head across eyes. Tegmina slightly longer than wide, its posterior margin more transverse than in many species, reticulation prominent but longitudinal veins not distinct. Lateral lobe of ninth abdominal segment of the *rhyparus* type, with length and width equal, the dorsal margin faintly concave, a broadly rounded apex, the ventral margin shorter than the length of the harpago showing beyond the lobe.

Male Genitalia: Anal flap (tenth abdominal segment) narrowed at base, then lateral margins running parallel a short distance so that the greatest width is just at base of stylus, apex again narrowed and the apical margin almost straight.

Harpago with basal portion narrowed, apex narrowly rounded and dorsal margin just back of middle extended into a short blunt hook, another external hook located anteriorly and ventrad to the first, its apex finely pointed and recurved.

Aedeagal structure large, its length slightly four times greater than its width. Base of aedeagus a rectangular plate with two short basal prongs and apically bearing two stout chitinous rods, each terminating in a membranous piece, with the part outside the theca bulbous, then abruptly terminating in a sharply pointed apex. Caudad the theca on the ventral side ends in two lobed parts which meet on the inner margin just posterior to middle; on the dorsal side its length is two-thirds only of the ventral length and its margin is straight.

Comparative Notes: This was described by Ball and Hartzell as a variety of *rhyparus* being distinguished by its smaller, slender body and the face more frequently transversely banded with light. This color difference of the face does seem to be somewhat distinctive.

The species in this paper has been placed in the *rhyparus* group which indicates that it resembles rather closely *rhyparus*, *junceus*, *concordus*, *bucculentus*, *disgregus* and *bilobatus*. For a general discussion of the six species see notes under the description of *rhyparus*.

Within the group it more closely resembles *bucculentus* and *disgregus* and *bilobatus*. For comparison of the former and latter see the notes in the description of *bucculentus*. From *disgregus* it is differentiated by being smaller and more obese in shape, having a narrower vertex and with apex of anal flap of male narrowed and truncate. In *disgregus* the vertex is distinctly heart-shaped and apex of anal flap of male has square corners and posterior margin straight. The lateral lobe of the ninth abdominal segment of the male is longer in *disgregus* with the dorsal margin approximately twice the length of the ventral while in *pajaronius* the latter is about two-thirds of the former. The male genitalia are distinct for the two species.

Location of Types: The types are in the National Museum, Washington, D. C.

Distribution: Described from Salinas and Watsonville, California. A series of specimens were used for study taken at the following places in California: Santa Cruz Mts., Stinson Beach, Upper Lake and Monterey.

***Orgerius bucculentus* n. sp.**

Size: Length of body from tip of head to tip of abdomen, male 4.8 mm. to 5.2 mm.; female 4.5 mm. to 4.7 mm. Greatest body width male 2.7 mm. to 2.9 mm.; female 2.9 mm. to 3.2 mm.

Color: Uniform rufo-testaceous with body thickly spotted with contrasting brown dots. Vertex uniformly spotted, no pronounced clusters along margins. Frons with anterior two-thirds uniformly spotted, back of which is a lighter transverse band with few spots, followed by a broad dark band which adjoins the dark band across gena around antennae and conspicuous dark band on ventral flap of pronotum. Anterior half of postclypeus light in sharp contrast to dark posterior half, this light band together with a corresponding light area on the thorax makes a conspicuous band across the head. Tegmina more uniformly fuscous than in related species, frequently contrastingly darkened as in Ball's *clitellus* variety. Abdomen and legs heavily spotted.

Structural Details: A chubby, broad species with a short broad vertex. Vertex, length only slightly greater than width, extended in front of eye not quite two-thirds length of eye. Median length of pronotum about three-fourths median length of vertex. Frons shorter than in some species, its length about one-fifth greater than width across eyes. Tegmina slightly broader than long, portion of abdomen exposed beyond tip of tegmen much longer. Reticulation less prominent, cells between larger, longitudinal veins more easily followed. Lateral lobe of ninth abdominal segment of male similar to *pajaronius* but differs by being somewhat shorter and broader across apex.

Male Genitalia: Anal flap (tenth abdominal segment) narrowed at base, bulging at middle with greatest width at base of stylus, then abruptly narrowing to a broadly pointed apex.

Harpago with basal portion narrowed, apex narrowly rounded and dorsal margin just back of middle extended into a short blunt hook, another external hook located anteriorly and ventrad to the first, its apex finely pointed and recurved, both hooks smaller than in *pajaronius*.

The aedeagal base is a large rectangular plate, bilobed basally and bearing on its caudal margin two sclerotized rods, each of which terminates in the usual membranous, elbow-shaped arm, most of which in this species is covered by a lobe of the theca except for the extreme terminal bulbous portion which narrows abruptly at end into an extremely fine pointed hook. On the dorsal side the theca is shorter than on the ventral surface but on either side it forms two large lobes with a deep cleft between them.

Comparative Notes: This species falls in the *rhyparus* group which means that it may be confused with *rhyparus*, *concordus*, *pajaronius*, *disgregus* and *bilobatus*. For a general comparison of these species see notes under this heading in the description of *rhyparus*.

Within the group *bucculentus* is more similar to *pajaronius*, *bilobatus* and *disgregus*. The vertex is distinguishable in these four species as follows: apex acutely pointed and margins straight and elevated in *pajaronius* and *bucculentus*, rounded in *disgregus* and *bilobatus*, with margins scarcely elevated, somewhat outwardly curved in *bilobatus*, distinctly so in *disgregus*; width of vertex in *pajaronius* eleven-sixteenths of length, in *bilobatus* six-sevenths, in *disgregus* three-fourths of length and in *bucculentus* width only slightly less than length. The pronotum varies as follows: in *bilobatus* the anterior margin is deeply concave behind eyes, the lateral margin forms an acute angle with the front margin, the shoulder width is greater

than the width of the disk between the lateral carinae; in *pajaronius* and *disgregus* the anterior margin is moderately concave, the lateral angle not pronounced and the shoulder is approximately equal in width to the median disk; in *bucculentus* there is no pronounced concavity or angle behind eye but the shoulder is wider than the median disk as in *bilobatus*. The frons in *disgregus* is longer being one-fourth longer than greatest width across eyes while in the others it is only approximately one-fifth longer. The tegmina in *bucculentus* are slightly wider than long, in the other three just the opposite. In situ the tip of the anal flap in the male varies as follows: broad and truncate in *disgregus*, narrowed and straight in *pajaronius*, roundly pointed in *bucculentus* and *bilobatus*. The lateral lobes of the ninth abdominal segments vary in length, longer with the dorsal margin a straight slope in *disgregus*, shortest with dorsal margin slightly concave near base in *bucculentus*, moderately long with dorsal margin slightly concave just back of apex in *pajaronius* and posterior margin bilobate in *bilobatus*. Distinct male genitalia occur in all the species as can be seen by an examination of the drawings.

Location of Types and Distribution: This species was described from the following specimens, collected by R. H. Beamer in Oregon, 1935; holotype male, one paratype male and female each, Criterion on July 2, allotype female, Kirby on July 15, one male paratype from Culver on July 2 and two male paratypes from Grant's Pass on July 12.

***Orgerius bilobatus* n. sp.**

Size: Length from tip of head to tip of abdomen, male 4.5 mm. to 5.3 mm.; female 4.7 mm. to 5.5 mm. Greatest body width, male 2.7 mm. to 2.8 mm.; female 3.2 to 3.6 mm.

Color: Male uniformly rufo-testaceous with small, inconspicuous spots or darker with greenish tint and speckled. Female somewhat darker and more heavily speckled. Vertex faintly barred, due to speckles arranged more or less in bands, one across both base and apex and a median one offset at lateral margins by contrasting light spots in front and behind, a pair of light brown triangular depressed areas near base. Frons with scattered clusters of spots forming two or three broad bands. Postclypeus with lighter oblique bands, brown areas near tip. Anterior half of pronotum with large dots, forming a broad dark band, followed by a clear light bar, posterior margin again speckled. Rest of dorsal surface of body uniformly speckled, tegmina and abdomen somewhat mottled with fuscous. Legs stramineous, heavily speckled, tips of tibiae and tarsi dark brown.

Structural Details: Vertex short, triangular, apex more rounded

than in other species, its width at apex one-half to one-third of basal width, lateral margins slightly elevated, greatest width between eyes six-seventh of its length. Frons short, broadly rounded across apex. lateral carinae parallel, except at a point near the base where it converges slightly. Pronotum short, anterior margin deeply concave behind eye, the median disk between the arcuate lateral carinae subequal to side portion, the posterior margin shallowly emarginate, arched forward to a point posterior to mid-line. Tegmina rugulose, veins distinct resembling the *rhyparus* group more than the *minor* group. Lateral lobe of the ninth abdominal segment of male, abbreviated into a bilobate plate, its width twice as great as greatest length, its posterior margin slightly concave at middle, the length of the plate about three-fourths the length of anal flap and harpago exposed beyond its tip.

Male Genitalia: Anal flap narrowed at base, lateral margins parallel for most of the length, gradually converging to a rounded apex. Stylus elongate, slightly broadened at tip.

Harpago, as viewed from a flattened lateral view, ovate, the dorsal margin just back of middle extended into a slender, pointed hook, an external ventrad directed hook located anterior to middle.

The basal plate of the aedeagus is rectangular, deeply notched at middle of anterior margin, apically bearing two slender sclerotized rods which extend caudad as far as apical dorsal margin of theca, then bend at right angles whence they taper to a pointed apex. Both ventral and dorsal margins of the theca are deeply bilobed the dorsal lobes a trifle shorter than the ventral ones.

Comparative Notes: This species resembles the following species: *bucculentus*, *pajaronius* and *disgregus*. It is easily distinguished by the more bluntly rounded vertex, the bilobate plate-like extension of the ninth abdominal segment in the male, and the deep concavity of the anterior margin of the pronotum behind the eye.

For a more detailed comparison with the above species see comparative notes in description of *bucculentus*.

Location of Types: Described from male holotype and female allotype collected from Mt. Diablo, California, on July 16, 1933 by R. H. Beamer. Seven female paratypes and fourteen male paratypes same data. These types are in the Know Entomological Collection, University of Kansas.

Orgerius junceus n. sp.

Size: Length from tip of head to tip of abdomen, male 5.0 mm. to 5.2 mm.; female 5.3 mm. to 5.5 mm. Greatest body width, male 2.75 mm.; female 3.0 mm. to 3.2 mm.

Color: Mottled dark and light yellow with small inconspicuous

darker spots. A few females somewhat lighter, and more rufous with spots more evenly distributed other females darker. Lateral carinae of vertex outlined with clusters of small dark spots, toward tip arranged in one or two bands. Median tablet of frons yellow or tan, anterior to middle the median carina speckled and five clusters of spots bordering each lateral carinae, just back of middle a yellow transverse band without speckles, followed by a narrower darker band, densely speckled; lateral compartment of frons darker around the antennae, yellow at each end. Postclypeus light orange at base with faintly oblique lines densely speckled at tip. Anteclypeus lemon yellow with two conspicuous speckled areas. Pronotum with lateral carinae and central carinae arcs black bordered with wedge-shaped dark spots. Mesonotum yellowish-tan, uniformly but sparsely speckled, carinae dark. Tegmina and abdomen uniformly punctate, mottled irregularly with dark brown to black spots.

Structural Details: A small ovate, slender species with vertex longer than in *rhyparus*. Vertex narrow, extending beyond eye one-half its length or a trifle longer; its greatest length subequal or slightly greater than twice its width, its lateral margins less foliaceous and elevated than in *rhyparus*. Frons moderately long, only about one-fourth longer than greatest width across eyes. Tegmina longer than wide, its length two-fifteenths longer than width, the longitudinal veins slightly thicker than the reticulation. Lateral lobe of the ninth abdominal segment of male, width greater than length, broader across apex and less pointed than *rhyparus*, its ventral length about equal to length of harpago, showing beyond the lobes.

Male Genitalia: Anal flap (tenth abdominal segment) slender at base; its lateral margins diverging to a point one-fourth of its length and running parallel for three-fourths of its length, then converging to form a sharp arc at tip. Stylus long, slender and finger-like.

Harpago with basal portion bluntly truncate, apex rounded and middle of dorsal margin extended into a sharply pointed, cephalad directed hook, another lateral external hook located anterior and ventrad to first, the apex of which is directed cephalo-ventrad.

Base of aedeagus forming a U-shaped sclerotized plate which supports two slender, chitinized rods running caudad to almost the full length of theca, the apical portion of each rod beyond the thecal margin recurved, membranous at base, bulbous, then forming a chitinized triangular apex bearing a strong hook. On the ventral side of the theca, the apical margin ends in three lobes on each side, the inner one extending beyond the other two. On the dorsal side the theca forms two lobes of equal size, the curved portion of which is

just below the curved membranous portion of the aedeagus and extends up to less than one-half the distance from the apex.

Comparative Notes. This species belongs in the *rhyparus* group which means that it may be confused with *rhyparus*, *concordus*, *pajaronius*, *bucculentus*, *disgregus* and *bilobatus*. For a general comparison of these species see notes under that heading in the description of *rhyparus*.

Within the group *junceus* more closely resembles *rhyparus* and *concordus*. It is separated from either by its longer vertex which in length is over twice its width while in *rhyparus* this width is five-eighths of the length and in *concordus* seven-tenths. The length of the body is shorter in *junceus* and the lateral lobe of the ninth segment is more broadly lobulate than in the other two. Distinct male genitalia occur for all species, the differences of each being more recognized by an examination of the drawings.

Distribution and Location of Types: Male holotype, three female and five male paratypes collected by R. H. Beamer from Arroyo Seco River, California, August 8, 1938. Female allotype, three male and three female paratypes, same collector from Lockwood, California on July 24, 1935.

Orgerius concordus Ball and Hartzell 1922

Orgerius rhyparus var. *concordus* Ball and Hartzell, Ann. Ent. Soc. Amer. XV: 144, 1922

Original Description

"Large obese form with the females averaging 5-6 mm., uniform dull fucous above, with a slightly pearl-gray sheen."

Described from two pairs from Cabazon, California, and Ti Juana, Mexico. This is the common variety in southern California extending from Visalia and Cabazon south and west to Ti Juana, Mexico.

Author's Description

Size: Length from tip of head to tip of abdomen, male 6.0 mm. to 6.3 mm.; female 6 mm. to 7 mm. Greatest body width, male 3 mm. to 3.5 mm.; female 4 mm. to 4.5 mm.

Color: A uniformly colored species with the general background yellowish-tan, varying to a gray-green, evenly speckled with brown. Occasional specimens are found with elytra dark brown or black in sharp contrast to the rest of the body. Lateral margins of vertex outlined with five clusters of brownish-black spots, separated by equal sized bare areas. Tegmina with cells between reticulations either solidly black or else heavily stippled on each side of the veins. Rest of dorsal surface heavily speckled with uniform round blackish-brown spots. Ventral part of body colored much as in *rhyparus* ex-

cept that the speckles are more numerous and conspicuous.

Structural Details: This is the largest species in the genus. Vertex moderately long, extending beyond eye one-half of its length, its greatest width approximately seven-tenths of its length and its lateral margins only slightly elevated. Frons elongate, approximately one-third longer than greatest width of head. Tegmina with length and width subequal although length a mere trifle greater, reticulation prominent, longitudinal veins not distinct. Lateral lobe of ninth abdominal segment, length slightly greater than width, its dorsal margin sloping in an oblique straight line to the broadly rounded apex, the ventral margin less than one-half the length of the dorsal margin and equal to the length of the harpago, showing beyond the lobe.

Male Genitalia: Anal flap (tenth abdominal segment) narrowed at base, lateral margins gradually diverging so that greatest width is at apex, the apical margin itself straight. Stylus showing only the knobbed tip beyond dorsal margin of the flap.

Harpago with basal portion narrowed, apex rounded and dorsal margin at middle extended into a short blunt, cephalad-directed hook; another external hook located anteriorly and ventrad to the first, its apex recurved like a shepherd's crook.

Base of aedeagus forming a U-shaped sclerotized plate, the arms of U curled inward and two slender, chitinized rods attached to its base. Dorsad the basal half of each rod is covered by the bilobed theca, the latter dividing into two equal lobes by a cleft running over half the length. The exposed part of each aedeagal rod runs caudad a short distance, then bends at a right angle like an elbow. The transverse portion of the arm is membranous with irregular fluted margins, then at the tip the structure ends in a sharply pointed chitinized cap.

Comparative Notes: This species is apt to be confused with *rhyparus*, *bucculentus*, *junceus* and *disgregus*. For comparison with these species see notes under the description of *rhyparus*.

Within the group *concordus* is more readily confused with *rhyparus* and *junceus*. It differs from *rhyparus* mainly in having a longer vertex extended in front of eye a greater distance than length of eye while in *rhyparus* the vertex is heart-shaped and extended in front of eye a distance equal to or a little less than eye. Proportionally the body of *rhyparus* is more obese than that of *concordus*. The lateral lobe of the ninth abdominal segment is shorter and slightly more angulate than in *concordus*. For differences between *concordus* and *junceus* see notes under the description of that species.

Location of Types. Dr. Ball's types are in the National Museum, Washington, D. C. The type localities are Cabazon, California and Ti Juana, Mexico.

Distribution: Dr. Ball stated that this is the common variety in southern California. Specimens were at hand for study from the following places in California: San Jacinto Mountains, Mint Canyon, Mountain Springs, Three Rivers, San Diego County, Jacumba, Anza, Miramar and Tehachapi.

***Orgerius spicatus* n. sp.**

Size: Length of body from tip of head to tip of abdomen, male, 5.0 mm. to 6.0 mm.; female 5.0 mm. to 5.5 mm. Greatest body width male 3.0 mm. to 3.6 mm.; female 3.0 mm. to 3.5 mm.

Color: Uniformly testaceous with slightly a reddish or sometimes greenish caste, speckled with fine dark dots. Vertex with lateral margins outlined with clusters of speckles, disk also conspicuously speckled. Shoulder carinae of pronotum outlined with about seven large black dots alternating with lighter clear areas, disk minutely speckled. Frons variable, some specimens yellowish-tan across central disk with a few minute dots, lateral margins outlined in black bordered with dark brown speckles, some with entire frons more heavily speckled. Postclypeus with basal two-thirds light, tip heavily mottled with dark blotches, dark brown speckles over all. Anteclypeus mottled with dark. Ventral pronotal flap uniformly speckled on anterior half, a small light arc just back of middle, fewer spots posteriorly. Tegmina with cells fuscous, those along posterior margin dark brown, veins lighter, margined with dark brown. Abdomen testaceous, mottled with fuscous, and heavily speckled.

Structural Details: A variable species in size, the difference in females amounting to one-half a millimeter, in males as much as one millimeter. Vertex triangular, its width about five-eighths of its length, the portion extended beyond the eye, about four-fifths of the length of the eye, the lateral margins moderately foliaceous and elevated. Frons shorter than in some species, about one-fourth longer than width of head across eyes. Tegmina with length and width subequal, a few longitudinal veins distinct, reticulation less prominent than in *rhyparus* group. Lateral plate of ninth abdominal segment of male almost a true triangle, length and width subequal, its dorsal margin a straight line, terminating in a short arc, the ventral margin slightly concave, anal flap and harpago extended only a short distance beyond apex of the lobe.

Male Genitalia: Anal flap (tenth abdominal segment) parallel-margined for almost two-thirds its length, lateral margins converging abruptly at base of apical third, apex rounded.

Harpago, as viewed from a flattened lateral view, distinct in shape, its ventral margin smoothly rounded, the dorsal margin arcuate at apical third, then gradually diverging to form a sharply pointed hook at apex of basal third, then converging to a narrow base, a second external recurved hook between the dorsal hook and base.

The aedeagus is composed of a basal sclerotized plate, the base of which is U-shaped while the apex bears two long sclerotized rods, which next end caudad. These rods are covered for most of their length by the theca, beyond the posterior margin of which they become membranous, make a sharp bend and finally at extreme apex form a slender chitinated spine. On the dorsal side thecal margin is truncate, on the ventral side it is four-lobed, the two outer lobes about twice the length of the middle ones and extending beyond the aedeagal arms a short distance.

Comparative Notes: *Spicatus* has a more distinct lobe on the ninth abdominal segment of the male than any other species. It is elongate and sharply pointed as to be described stiletto-like. This along with its extended vertex immediately separates it from the minor group.

If the ninth segment lobe is considered *spicatus* is more similar to *proprius* and *triquestrus*. For comparison of these three species see notes under description of *triquestrus*.

On the basis of the vertex and other characteristics it more closely resembles *rhyparus* and *disgregus*. From *rhyparus* it is distinguished by its broader vertex with tip less narrowed so that the width across apex is only one-third of the basal width while in the latter the apex width is one-fourth of the base. From *disgregus* it is separated by having a longer vertex, with lateral margins somewhat constricted before apex and tegmina with faint reticulation but strong longitudinal veins while in *disgregus* the vertex is broad, lateral margins are outwardly rounded and the reticulation is stronger.

Location of Types and Distribution: Described from male holotype and female allotype, collected by R. H. Beamer and L. W. Hepner from Topango Canyon, California, on August 5, 1938. Paratypes collected in the following places in California by R. H. Beamer, four males, Monrovia, July 27, 1935; two males and one female, Ventura, July 20, 1933; two males and two females, Santa Maria, July 19, 1933; one male and two females, Claremont, July 29, 1935; one male and one female, Beaumont, July 26, 1933. These types are in the Snow Entomological Collection at the University of Kansas.

***Orgerius disgregus* n. sp.**

Author's Description

Size: Length of body from tip of head to tip of abdomen, male

5.5 mm. to 5.7 mm.; female 5.3 mm. to 5.5 mm. Greatest body width; male 3.1 mm. to 3.4 mm.; female 3.3 mm. to 3.5 mm.

Color: Varying from golden testaceous to deep fuscous both sexes heavily spotted. Lateral margins of vertex black bordered with three clusters of blackish dots, other spots lighter brown. Frons and clypeus with much the same markings as *concordus*. A semi-rectangular light spot on ventral pronotal flap present but not as conspicuous as in *pajaronius*. Tegmina with cells between reticulations margined in brownish-black. Rest of dorsal surface heavily speckled with uniform round blackish-brown spots. Under surface the same.

Structural Details: An obese species with heart-shaped vertex. Vertex broad, its width three-fourths of its length, its length in front of eye about two-thirds the length of the eye itself, its median length twice the median length of pronotum and its lateral margins not foliaceous, only slightly elevated. Frons elongate, approximately one-fourth longer than greatest width of head across eyes. Tegmina with length and width subequal, portion of abdomen exposed beyond tip of tegmina equal to length of latter. Reticulation prominent, longitudinal veins indicated at base but not prominent. Lateral lobe of ninth abdominal segment of male similar to *rhyparus* but more conspicuously lobulate. Its length and width equal, the dorsal margin obliquely sloping to the broadly rounded apex, the ventral margin over half the length of the dorsal but shorter than the length of the harpago exposed beyond its tip.

Male Genitalia: Anal flap (tenth abdominal segment) narrowed at base, lateral margins outwardly curved so that greatest width is just posterior to tip of stylus, apex again narrowed and the apical margin straight.

Harpago ovate, dorsal and ventral margins uniformly rounded, middle of dorsal margin prolonged into a recurved hook, anterior to it an external hook which has a finely pointed recurved apex.

Basal plate of aedeagus a small bilobed plate from which running caudad are two stout chitinous rods each becoming membranous and forming a bulbous structure after which it tapers to a sharp point. On its ventral surface the theca terminates caudad in a bilobed portion, each lobe being subdivided into two lobes, a median large and outer smaller one. On the dorsal surface the theca is bilobed, the cleft in this case extending basally one-third of the length of the theca from the apical margin.

Comparative Notes: This species falls in the *rhyparus* group of species and therefore may be confused with *rhyparus*, *junceus*, *concordus*, *bucculentus*, *pajaronius* and *bilobatus*. For a general com-

parison of these species see notes under this heading in the description of *rhyparus*.

Within the group it is more easily confused with *pajaronius* and *bucculentus*. For a comparison with these two species see the notes in the description of these species.

Location of Types and Distribution Notes: Described from male holotype and female allotype, collected by R. H. Beamer from Orange County, California, on July 14, 1929. Two male and five female paratypes same data. These types are in the Snow Entomological Collection, University of Kansas.

***Orgerius bicornis* n. sp.**

Size: Length of body from tip of head to tip of abdomen, male 4.4 mm. to 4.5 mm.; female 4.5 mm. Greatest body width, male 2.7 mm. to 3.0 mm.; female 3.0 mm. to 3.2 mm.

Color: Stramineous with faint markings of rust brown. Vertex with outer margins dark brown, faintly mottled across disk with rust brown. Eyes stramineous spotted in brown. Under side of body stramineous. Frons with a faint lighter yellow transverse band just before apex, rest of disk and genae lightly stippled in faint brown. Postclypeus yellow, lightly mottled in red brown toward apex. Anterior half of pronotal flap darkened, uniformly speckled with small reddish-brown spots. Mesonotum slightly greenish through middle, small brown speckles on lateral disks, a pair of round spots midway of length and apex reddish-brown. Tegmina tan with veins outlined on each side with brown, giving the appearance to the tegmina of being mottled. Abdomen uniformly stramineous, speckled with minute indistinct reddish-brown spots. Legs stramineous, speckled in light reddish-brown. Tarsi of all legs dark brown.

Structural Details: A small, moderately obese species with short triangular vertex. Vertex extended in front of eye a distance about three-fourths of distance behind anterior margin of eye, width across apex slightly less than one-third of basal width, greatest width about four-fifths of length, lateral margins markedly foliaceous, dilated mesad of eye into almost a horn-like expansion. Frons shorter than in many species, lateral length equal to length of clypeus, broadest just posterior to eyes, its anterior margin truncate. Postclypeus inflated. Pronotum short, the lateral shoulders shorter than in *rhyparus*, the median disk between the arcuate lateral carinae wider than the side portion, the posterior margin shallowly emarginate, extending forward to a depth of about one-third the pronotal length. The pits of the pronotum larger in diameter but less in numbers on each lateral disk numbering about seventeen or eighteen. Tegmina rugulose, the longitudinal veins not easily traceable. Abdominal

segments each with a prominent median carina and two lateral carinae. Lateral lobe of the ninth abdominal segment of male abbreviated into a broad plate instead of a lobe, its width a little over twice its length at the ventral side, the posterior margin deeply concave, the portion of the harpago, showing beyond tip of plate about one-half again as long as the length of the latter.

Male Genitalia: Anal flap (tenth abdominal segment) narrowed at base, its lateral margins diverging until greatest width is through median third, beyond this point gradually narrowing again to a rounded apex.

Harpago, as viewed from a flattened lateral view, ovate, with the dorsal margin extended into a broad, cephalad-curving hook at base of apical third, just cephalad of which is another external hook which curves downward and slightly cephalad.

The basal plate of the aedeagus is rectangular, deeply notched at middle of anterior margin, constricted midway on each lateral margin and apically bears two slender sclerotized rods which bend at right angles just beyond dorsal margin of the theca. The basal part of exposed arm is membranous, slightly bulbous, the apical part is chitinized and ends in a sharp point. Both ventral and dorsal margins of the theca are deeply bilobed, the dorsal lobes a trifle shorter and smaller than the ventral lobes.

Comparative Notes: *Bicornis* falls in the **minor** group due to the fact that the lobe of the ninth segment in male is plate-like, being much broader than long, the pronotal shoulders are shorter and narrower, and the hind tibiae are not foliaceous at base. The species in the **minor** group include, *ventosus*, *minor*, and *foliatus*. The four species are distinguished as follows: vertex broader, margins extremely foliaceous, forming two horns mesad of eye in *bicornis*, tip more rounded margins straight, less elevated in *ventosus* and *minor* lateral margins distinctly foliaceous, constricted before apex, apex narrowed in *foliatus*. The vertex in *minor*, although similar in shape is shorter than in *ventosus*; the coloring of the four species is somewhat different although the males in all tend to be uniform light yellowish-tan, *ventosus* and *minor* are mottled species with conspicuous darker spots at the sides of the abdominal segments near the apex; the frons of *bicornis* is proportionally wider and more truncate at anterior margin between eyes than in other species; the lateral lobe of the ninth abdominal segment of the male varies, in *bicornis* having a deeply concave posterior margin, in *foliatus* a straight, sloping one, in *ventosus* a shallowly concave one and in *minor* straight until just before apex where it is concave. The

male genitalia vary for the four species as can be seen in the drawings.

Location of Types and Distribution: Described from male holotype and female allotype, collected at Glenwood, Utah, on August 12, 1936, by R. H. Beamer. Thirteen paratype females and eleven paratype males same data. One male and four female paratypes taken at Elsinore, Utah, August 12, 1936. and one male paratype, Soldier Summit, Utah, on August 13, 1936, same collector.

***Orgerius foliatus* n. sp.**

Size: Length of body from tip of head to tip of abdomen, male, 4.2 mm. to 4.5 mm.; female 4.2 mm. to 4.6 mm. Greatest body width, male 2.5 mm. to 2.7 mm.; female 2.7 mm. to 2.9 mm.

Color: Male, uniform stramineous or slightly darker with small brown specks and spots. Female darker and more heavily spotted. Lateral margins of vertex thinly outlined in brown, bordered by three clusters of brown spots and a pair of light brown triangular depressed areas near base. Head and thorax region from below light yellow, conspicuously barred as follows: a broad dark fuscous band, uniformly speckled with brown flecks extending across apical fourth of frons, surrounding antennae on the gena, and continuing across middle of pronotal flap, a second but fainter dark band across frons between eyes, a third narrow band across apex of postclypeus and adjacent coxae of front legs. Pronotum stramineous, only faintly darker on carinae and margins in some specimens, in others larger brown spots bordering the margins. Rest of dorsal surface sparsely stippled with brown. Tegmina uniform stramineous or slightly mottled by having cells bordered with small brown spots. Legs yellow, variously mottled with light reddish-brown spots of varying sizes.

Structural Details: A small, slender species of the **minor** group in that the lateral lobe of male ninth segment is much wider than long. Vertex acutely pointed at apex extended beyond eye a distance equal to half its length, its greatest width about three-fifths of its length, lateral margins distinctly foliaceous and elevated, especially from side view. Frons short but anteriorly narrowed, forming a conical apex. Pronotum short, the lateral shoulders shorter as in **minor**, the median disk between the arcuate lateral carinae only slightly wider or equal to side portion, the posterior margin shallowly emarginate arched forward to a point posterior to mid-line. Tegmina rugulose, the longitudinal veins more distinct than in **minor**, rest of reticulation less pronounced than in the **rhyparus** group. Abdominal segments carinate as in **minor** but inner carina less distinct. Lateral lobe of the ninth abdominal segment of male abbreviated into a broad triangular plate, its width three times its length at the ven-

tral side, the posterior and ventral margins almost meeting at a right angle, the portion of both the anal flap and harpago showing beyond this angle twice the length of the margin.

Male Genitalia: Anal flap (tenth abdominal segment) constricted at base, the lateral margins broadly arcuated, the apex smoothly rounded. Stylus finger-like but broad and short.

Harpago, as viewed from a flattened lateral view somewhat ovate, the dorsal margin extended just back of middle into an acutely pointed hook, an external ventrad-directed hook located at about the mid-line.

Base of aedeagus wedge-shaped, posteriorly bearing two slender sclerotized rods which are recurved just beyond dorsal margin of the theca. These rods are shorter than in *minor*, but the basal part of their exposed arm is membranous, slightly bulbous, followed by the sclerotized finely pointed apical region just as in *minor*. On the dorsal side the theca is half as long as on the ventral side, the posterior margin is extended into two slender lobes, separated by a rectangular cleft. Ventrad the theca ends in two lobes whose frilled margins meet about two-thirds the distance from the base.

Comparative Notes: *Foliatus* falls in the *minor* group due to the fact that the lobe of the ninth segment in the male is plate-like, being much broader than long, the pronotal shoulders are shorter and narrower than the median disk and the hind tibiae are not foliaceous at base.

The species is characterized by the very long vertex with distinctly foliaceous, elevated lateral margins which constrict before apex, making the width across apex conspicuously narrow, a broad frons with the anterior margin more truncate and characteristic male genitalia.

It more closely resembles *bicornis*, *minor* and *ventosus*. For further details of comparison see the notes in the description of *bicornis*.

Location of Types and Distribution: Described from male holotype and female allotype, collected by R. H. Beamer on June 30, 1932 from Alamagordo, New Mexico. Twenty male paratypes and twelve female paratypes same data. Eleven female and twenty-one male paratypes from White Sands, New Mexico, Collected by R. H. Beamer, June 27, 1940.

***Orgierius ventosus* Ball and Hartzell 1922**

Ball, E. D. and Hartzell, A. Ann. Ent. Soc. Amer. 15, page 145, 1922, as *Orgierius rhyparus* var. *ventosus*.

Original Description

"Resembling *pajoronius* in size and form, dimorphic, in color, the female mottled fuscous and white, the central tablet of pronotum and scutellum almost creamy, the face trifaciate with light. Male clear yellowish-white with a few fuscous spots on the lateral carinae of the vertex.

"Described from three pairs from Mojave, California, taken July 30. This peculiar form appears to be strictly confined to the sparse vegetation of that windy and inhospitable desert region. Most of the specimens were beaten from a low spiny white shrub.

Author's Description

Size: From tip of head to tip of abdomen, male 4.0 mm.; female 4.2 mm. to 4.7 mm.; Greatest body width, male 2.4 mm. to 2.6 mm.; female .5 mm. to 2.7 mm.

Color: A dimorphic species, male uniform pale yellow with a few dark spots; female general color a dark tan, irregularly spotted. Male marked as follows: Vertex with faint reddish-brown spots sometimes present, concentrated at tip, a few along lateral margins, a pair of depressed darker areas near base; frons with two faint darker bands of speckles indicated at apex and just in front of middle, lateral compartments sparsely speckled with minute red spots; clypeus with oblique streaks of dark on central disk; ventral pronotal flap darkened and slightly speckled on anterior half, posterior half light. Tegmina cream colored, semi-transparent. Abdomen light yellow the minute lateral pores dark brown and one larger dark brown spot in each segment along each lateral border. Female marked as follows: from below speckles same location as in male but greatly intensified; vertex with a median transverse band of speckles in addition to apical and lateral ones. Pronotum with pits centered with red-brown and surrounded with fuscous. Mesonotum lightly speckled across disks, conspicuous darker areas of brown spots concentrated in extreme lateral corners, a pair of round brown spots just back of middle and one at extreme apex. Tegmina cream-colored to gray, veins cream, outlined on both sides with brown; abdominal segments from above conspicuously mottled due to concentration of the brown speckles into clusters, and conspicuous lateral brown spots on lateral margins which are larger than in male and a few large brownish-black spots extending almost completely across the last few segments.

Structural Details: Vertex broadly triangular, extended in front of eye a distance equal to half its length, its width two-thirds of its length, tip moderately pointed, at this point about one-fourth of its basal width, lateral margins moderately elevated. Frons narrower

than in *bicornis*, its anterior margin truncate. Pronotum size and shape of *minor*, the lateral shoulders shorter than in *rhyparus*, the median disk between the arcuate lateral carinae wider than the side portion, the posterior margin shallowly emarginate. Pits of pronotum smaller, brown centered so that they are easily distinguished, about eighteen or nineteen in each lateral portion. Tegmina semi-transparent, scarcely any reticulation between longitudinal veins distinguishable in the male, somewhat more prominent in female. Lateral lobe of ninth abdominal segment of male abbreviated into a very short broad plate, whose width is about four times its greatest length, its posterior margin shallowly concave and with the harpago exposed beyond its tip, a distance about twice its ventral length.

Male Genitalia: Anal flap broad at base, side slightly diverging to a distance of three-fourths of length then converging to end in a rounding tip. Stylus bell-shaped.

Harpago, as viewed from a flattened lateral view, ovate, with the dorsal margin extended into a broad, cephalad-curving hook at base of apical third, just cephalad of which is another external hook which curves downward and slightly cephalad.

Base of aedeagus wedge-shaped, its anterior margin deeply split and its posterior margin bearing two slender sclerotized rods which are recurved just before the truncate dorsal margin of the theca. The rods are short as in *foliatus*. The basal part of the curved portion is membranous, the apical part forms a slender sclerotized pointed hook. On the ventral side the theca forms two long slender lobes which extend some distance beyond the tip of the dorsal margin.

Comparative Notes: In the original description of this variety Ball placed it as a variety of *rhyparus*, distinguishing it on smaller size and color, namely the trifasciate face and pronotum and scutellum being almost creamy.

In structural details *ventosus* resembles *minor* rather than *rhyparus* in that the lobe of the ninth segment in the male is plate-like being much broader than long, the pronotal shoulders are shorter and narrower and the hind tibiae are not foliaceous at base. It also resembles other species in the *minor* group which are *bicornis* and *foliatus*. For a comparison with these species see notes in the description of *bicornis*.

Location of Types: In the National Museum, Washington, D. C.

Distribution: Described from Mojave, California. Studies were made for this paper from a long series from the type locality and in addition a long series from Palmdale, Yucca Grove, and Cuyama Grove and Las Vegas, Nevada.

Orgerius minor Ball, 1909

Ball, E. D. Proc. Bio. Soc. Wash. XXIII, page 202, 1909.

Original Description

"Resembling *rhyparus* but smaller, paler, with shorter, blunter vertex. Pale straw or slightly smoky. Length 4.5 mm.

Vertex triangular, broad at base, much broader than in *rhyparus* and scarcely as long, less than twice as long as its basal width, the apex acute, lateral carinae elevated. Front broad, the median tablet narrow and elevated. As seen from the side, the front is straight and meets the vertex in an acute angle with the apex a trifle rounding. Elytra as in *rhyparus*. Anal tube of male short, the lower part produced into a pointed tip covering the plates. Plates narrow, strap-shaped, scarcely or not at all inflated. Described from twelve specimens from Colorado and Utah collected by the author."

Author's Description

Size: Length from tip of head to tip of abdomen, male 5.1 mm. to 5.3 mm.; female 4.7 mm. to 5.2 mm. Greatest body width, male 2.5 mm.; female 2.5 mm. to 2.7 mm.

Color: A dimorphic species but less so than in *ventosus*. Male uniform pale greenish-yellow with faint reddish-brown speckling; females with markings more pronounced. Vertex of male faintly stippled, thin lateral margins brown, two light brownish areas near base. Rest of dorsum including tegmina, uniform cream yellow with faint stippling of reddish-brown flecks. Vertex of female with three indefinite transverse bands of speckles, depressed dark areas larger, thorax mottled with dark, tegmina with veins margined in dark, abdomen heavily mottled, with speckles arranged in clusters, a large brown spot in posterior outer corner of each notum, other large dark spots on posterior segments. Undersurface of male head and thorax, cream colored, the usual transverse bands faintly stippled; females slightly darker. Legs pale, faintly mottled and stippled with reddish-brown.

Structural Details: Vertex broadly triangular, extended in front of eye a distance equal to a distance equal to half its length, its greatest width five-eighths of its length, moderately pointed at apex, lateral margins moderately elevated. Frons somewhat narrowed anteriorly between eyes, slightly inflated behind. Pronotum shorter than in the *rhyparus* group, the lateral shoulders abbreviated, their width not as great as width of median disk between the lateral carinae, posterior margin emarginate to a depth of less than one-half pro-

notal length. Pits of pronotum seemingly smaller than in some species, numbering about sixteen to seventeen. Tegmina with a reticulation moderately heavy, longitudinal veins not readily distinguishable. Lateral lobe of ninth abdominal segment of male abbreviated into a short broad plate, whose width is about twice its greatest length, its posterior margin a straight slope until just its rounded apex where it is slightly constricted, the portion of the harpago exposed beyond its tip about twice its ventral length.

Male Genitalia: Anal flap (tenth abdominal segment) ovate, twice longer than wide, apex roundly pointed.

Harpago, as viewed from a flattened lateral view, ovate with the dorsal margin extended into a blunt curved hook at apex of middle third, in front of this an external recurved hook present.

Base of aedeagus a semi-rectangular plate, anteriorly deeply cleft, posteriorly bearing two slender sclerotized rods which extend caudad to a point about two-thirds of the length, then bend cephalad at an acute angle, most of the exposed portion of the hook membranous, the terminal portion in the form of a slender sclerotized spine. The theca unique for the genus, its dorsal posterior margin extended caudad as a triangle, the apex of which is deeply cleft into two slender lobes. The dorsal margin of the theca forms two broad, widely separated lobes, with a deep wedge-shaped cleft between.

Comparative Notes: Ball distinguished *minor* from *rhyparus* by the characters of a wider vertex and the posterior tibia being unmodified while in *rhyparus* the posterior tibia was distinctly flattened basally, the heavy spines appearing as serrations.

In the present study *minor* is grouped with several other species which have the lateral lobe of the ninth abdominal segment of the male broader, more plate-like, rather than lobe-like, the pronotal shoulders shorter and narrower and the hind tibia normal. The species represented in this group are *bicornis*, *foliatus* and *ventosus*. For comparison of *minor* with these species see the notes in the description of *bicornis*.

Location of Types: In the National Museum Collection, Washington, D. C.

Distribution: Described from specimens collected in Colorado and Utah. Specimens were at hand for study from Grand Junction and Montrose, Colorado and from Wellington, Utah.

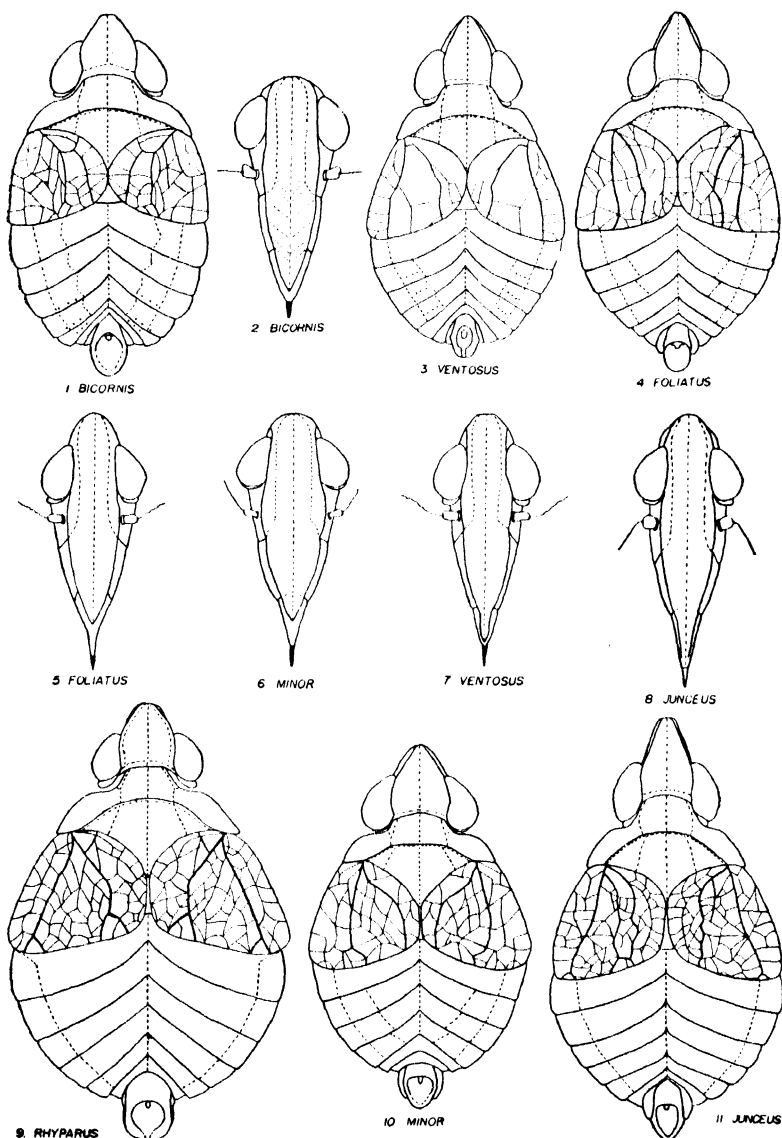


PLATE I.

1. Dorsal view, **bicornis**
2. Ventral view of head, **bicornis**
3. Dorsal view, **ventosus**
4. Dorsal view, **foliatus**
5. Ventral view of head, **foliatus**
6. Ventral view of head, **minor**

7. Ventral view of head, **ventosus**
8. Ventral view of head, **junceus**
9. Dorsal view, **rhyparus**
10. Dorsal view, **minor**
11. Dorsal view, **junceus**

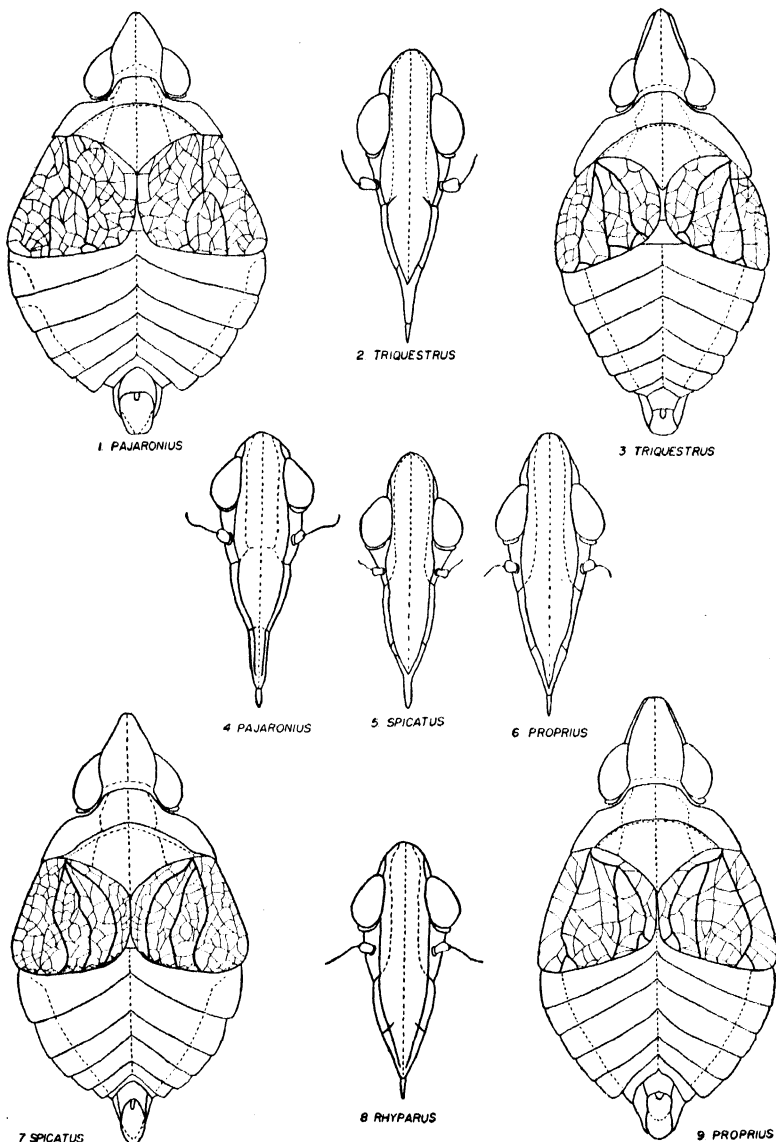


PLATE II.

1. Dorsal view, **pajaronius**
2. Ventral view of head, **triquestrus**
3. Dorsal view, **triquestrus**
4. Ventral view of head, **pajaronius**
5. Ventral view of head, **spicatus**
6. Ventral view of head, **proprius**
7. Dorsal view, **spicatus**
8. Ventral view of head, **rhyparus**
9. Dorsal view, **proprius**

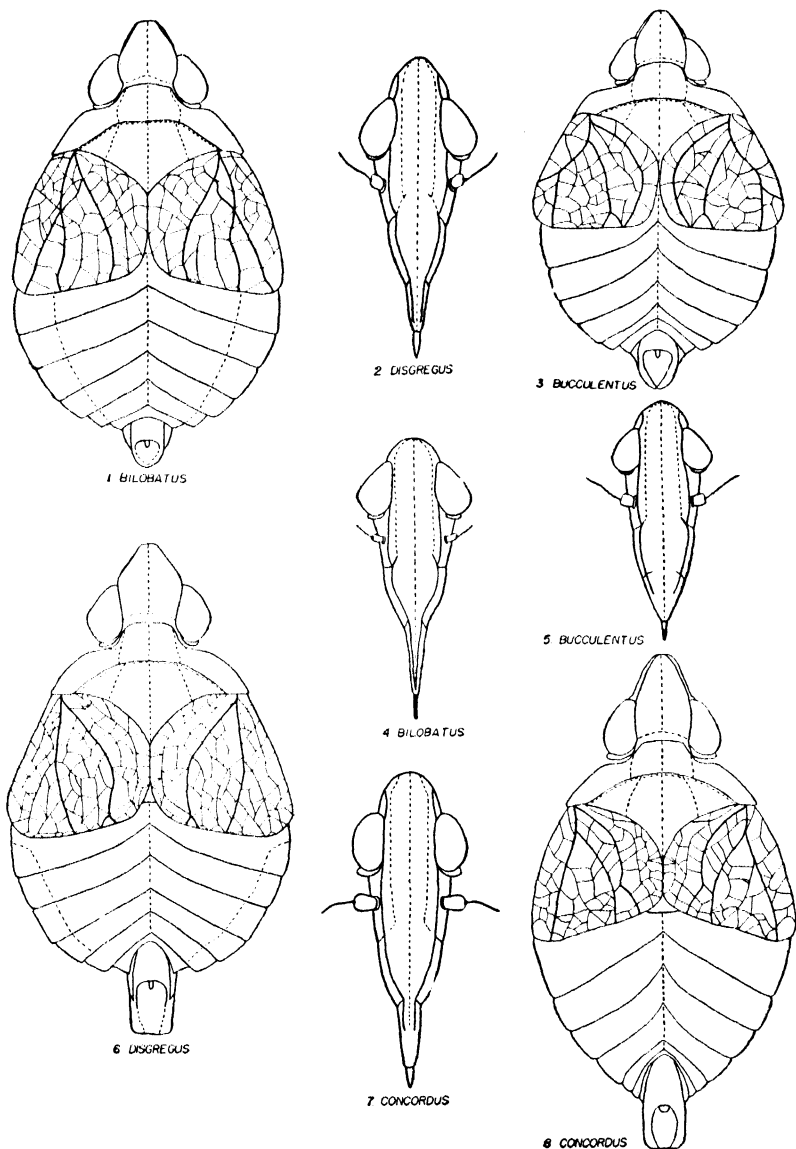


PLATE III.

1. Dorsal view, *bilobatus*
2. Ventral view of head, *disgregus*
3. Dorsal view, *bucculentus*
4. Ventral view of head, *bilobatus*

5. Ventral view of head, *bucculentus*
6. Dorsal view, *disgregus*
7. Ventral view of head, *concordus*
8. Dorsal view, *concordus*

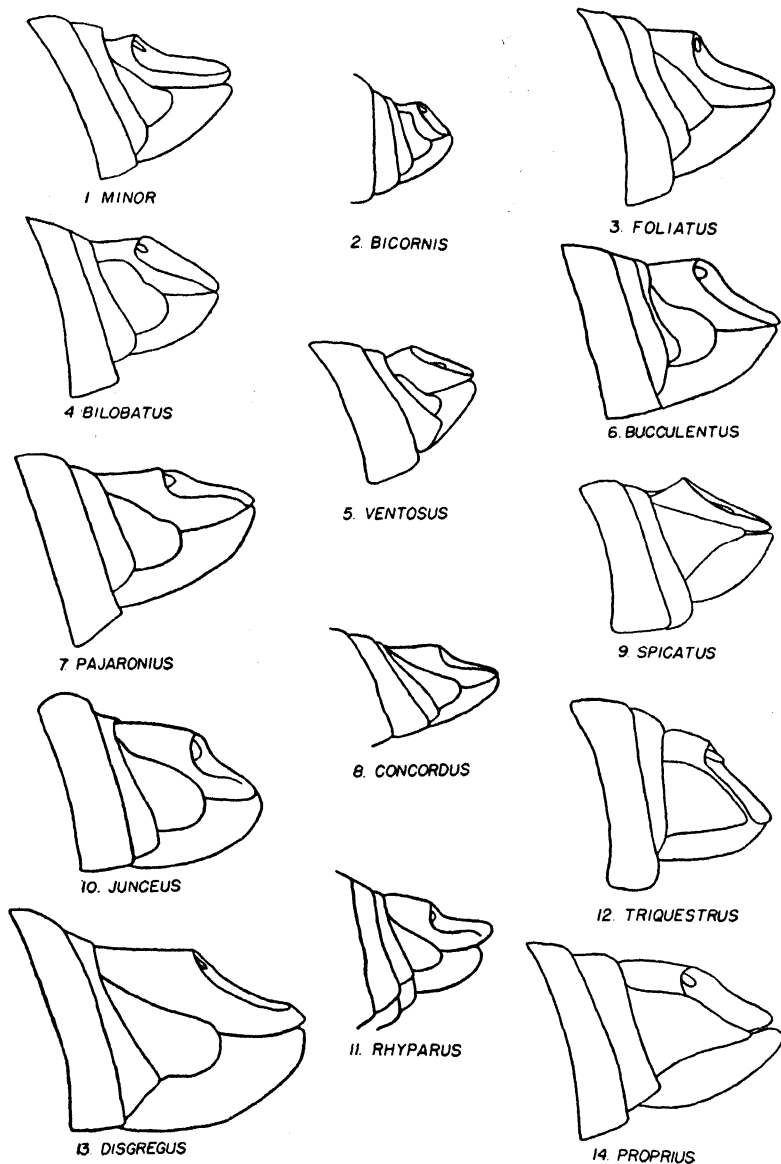
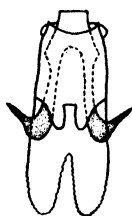
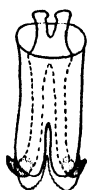


PLATE IV.
LATERAL VIEW OF MALE NINTH ABDOMINAL SEGMENT

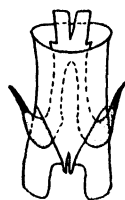
- | | | | |
|--------------|----------------|-----------------|---------------|
| 1. minor | 5. ventosus | 9. spicatus | 13. diagregus |
| 2. bicornis | 6. bucculentus | 10. junceus | 14. proprius |
| 3. foliatus | 7. pajaronius | 11. rhyparus | |
| 4. bilobatus | 8. concordus | 12. triquestrus | |



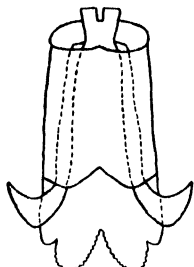
1. FOLIATUS



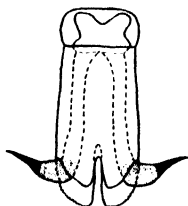
2. BILOBATUS



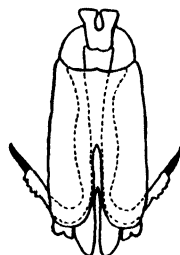
3. MINOR



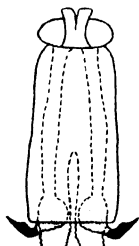
4. RYPARUS



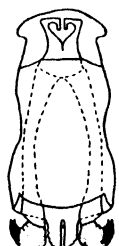
5. BICORNIS



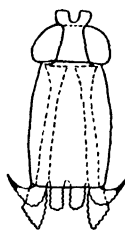
6. JUNCEUS



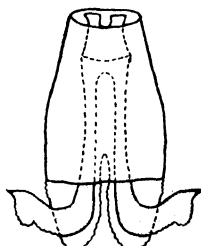
7. PROPRIUS



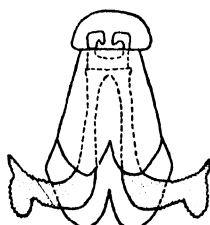
8. TRIQUESTRUS



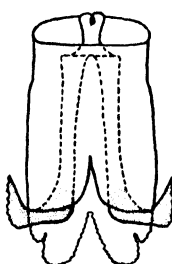
9. SPICATUS



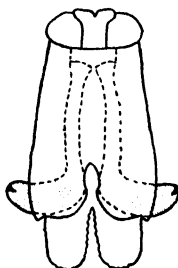
10. PAJARONIUS



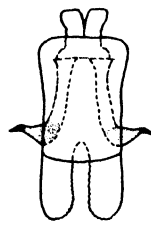
11. CONCORDUS



12. DISGREGUS



13. BUCCULENTUS



14. VENTOSUS

PLATE V.

DORSAL VIEW OF AEDEAGUS AND THECA

1. foliatus
2. bilobatus
3. minor
4. rhyparus

5. bicornis
6. junceus
7. proprius
8. triquestrus

9. spicatus
10. pajaronius
11. concordus
12. disgregus

13. bucculentus
14. ventosus

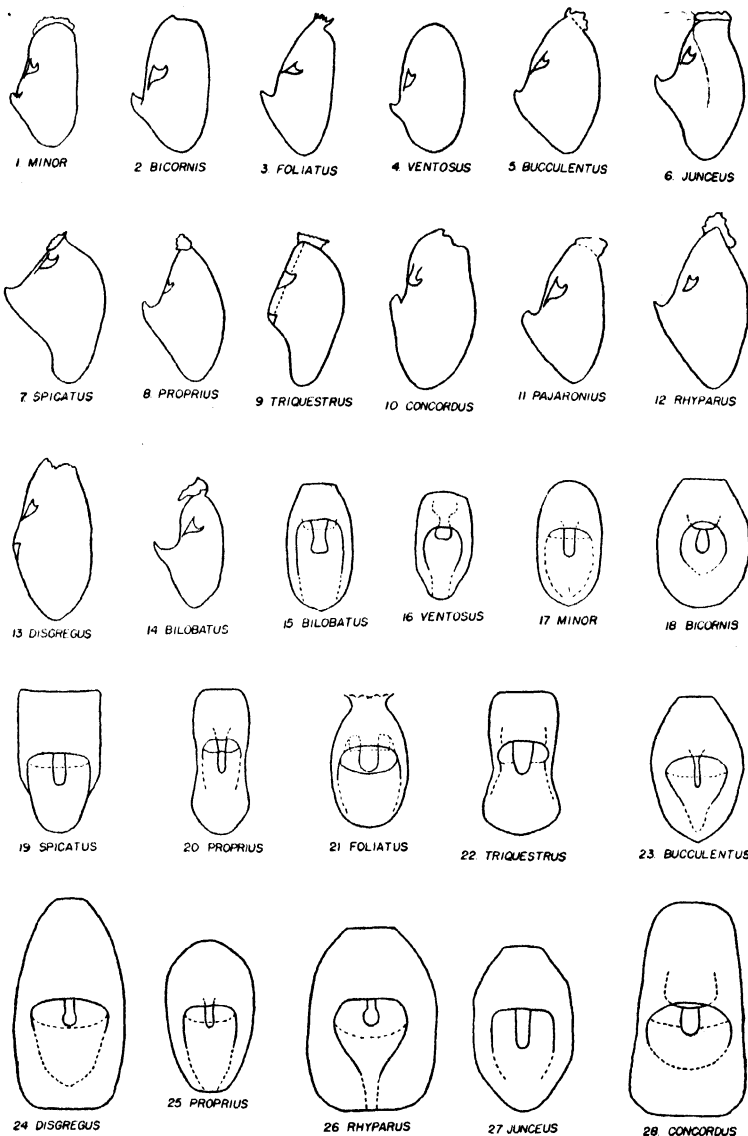


PLATE VI.

Flattened Lateral View of Harpagones				Anal Flap (10th Abdominal Segment) of Male			
1. minor	8. proprius	15. bilobatus	22. triquestrus	22. triquestrus			
2. bicornis	9. triquestrus	16. ventosus	23. bucculentus	23. bucculentus			
3. foliatus	10. concordus	17. minor	24. discregus	24. discregus			
4. ventosus	11. pajaronius	18. bicornis	25. proprius	25. proprius			
5. bucculentus	12. rhyparus	19. spicatus	26. rhyparus	26. rhyparus			
6. juncus	13. discregus	20. proprius	27. juncus	27. juncus			
7. spicatus	14. bilobatus	21. foliatus	28. concordus	28. concordus			

THE TWELFTH OR 1942 ANNUAL INSECT POPULATION SUMMARY OF KANSAS*

ROGER C. SMITH and E. G. KELLY¹
Kansas Agricultural Experiment Station

This insect population summary for Kansas covers the calendar year 1942 and is the twelfth in a continuous series which began with the year 1931.² The information recorded here is based on a summary of 258 questionnaires of the score card type from the sources indicated in Table I together with the observations and comments of the authors, their colleagues and of those returning the score sheets.

Table I

Source of Questionnaires Returned and Summarized for this Report

	No. in July	No. in October
Group 1. Entomologists in the state -----	14	14
Group 2. County Agricultural gents -----	36	65
Group 3. Farmers, mostly college graduates -----	6	7
Group 4. Vocational agricultural teachers -----	58	38
Total reports of each group -----	114	144
Grand total of all questionnaires summarized for this report -----		258

Summary of Weather Conditions (Fig. 1 and Table II) in Kansas by Months for 1942³

January was deficient in precipitation in practically every part of the state, though the soil was saturated in all but the southwestern counties. The first ten days were exceptionally cold but the remainder of the month was mild and pleasant with ample sunshine. Much snow fell in the northern and western parts of the state on the first day of the month and the ground remained covered with snow during the cold period.

*Contribution No. 524 from Department of Entomology.

¹Associate Entomologist, Kansas Agricultural Experiment Station and Extension Entomologist, Division of College Extension, respectively.

Recognition and appreciation for assistance given during the preparation of this summary is due to the same sources and largely to the same individuals who supplied information for more recent, previous reports. They consist of the group given in Table I.

²For the other summaries in this series, see the *Journal of the Kansas Entomological Society* for the summaries for 1931 (vol. 5); 1932 (vol. 6); 1933 (vol. 7); 1936 (vol. 10); 1937 (vol. 11); and 1939 (vol. 13) and *Transactions of the Kansas Academy of Science* for 1934 (vol. 38); 1935 (vol. 39); 1938 (vol. 42); 1940 (vol. 44); 1941 (vol. 45.).

³Based largely on Climatological Data, Kansas Section, by S. D. Flora. U. S. Dept. Agr. Weather Bureau, v. 56, 1942.

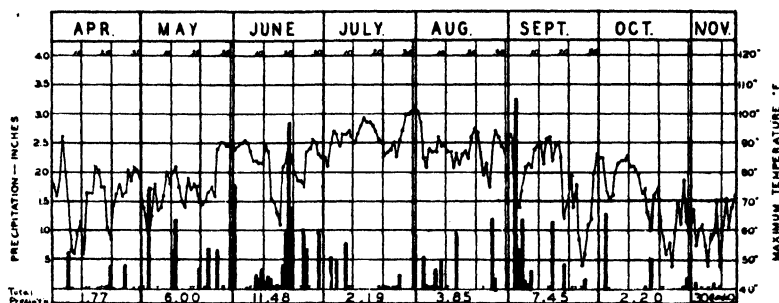


Fig 1. Daily rainfall and maximum temperature chart for the growing season of 1942 at Manhattan, Ks. Chart prepared by D. A. Wilbur.

February was characterized by frequent precipitation, rather heavy snowfall and prolonged cold after the opening days. The soil in eastern counties was excessively wet. From three to six or more inches of snow fell in almost every county. A cold wave arrived on the 16-17th and the cold persisted through the remainder of the month. It was a favorable month for wheat except in the eastern third of the state.

March had ample precipitation, above normal temperature and normal sunshine. Snowfall was light except in the western third where four to eight inches fell. Wet soil delayed farm work and cold weather the last week held back truck crops and fruit bloom.

April was one of the wettest, mildest and most favorable months for crop growth that was ever recorded in Kansas for this time of year. Rains were frequent. There was no freezing weather during the last half of the month and crops made fine growth.

May was one of the wettest on record in northeastern counties but in the western third, there was less rain than in any other May except one. Temperatures were abnormally low for the first 25 days. The closing days were hot and sultry. Some hail and windstorms occurred and the upper Arkansas river valley was flooded. Wet soil hampered corn planting but pastures and truck crops made fine growths.

June was exceptionally wet and cloudy. Numerous floods, wind and hail storms occurred in the state. There was a near record cold period near the middle of the month. Wheat harvest and haying were seriously hampered by frequent rains and wet soil.

July was hot and dry. It resembled this month for the last 13 years except the temperature was not so high. Rainfall was deficient except in the southeastern part of the state. Sunshine was normal.

August had frequent rains, some of which were heavy. It was

TABLE II.

Summary of Weather Data for the State of Kansas for the period
September 1, 1941 to December 31, 1942.

Month	Temperature in degrees Fahrenheit					Precipitation in inches					
	State Average	Max- imum	Min- imum	Average for 56 years	Depart- ure from normal	State Average	Average for 56 years	Depart- ure from normal	East- ern third	Middle third	West- ern third
September 1941	71.0°	103°	32°	69.8°	+1.2°	4.76	2.80	+1.96	6.51	4.72	3.05
October "	58.4°	95°	20°	57.3°	+1.1°	6.51	1.97	+4.54	10.29	6.57	2.66
November "	45.1°	87°	- 4°	43.2°	+1.9°	0.88	1.29	-0.41	1.29	0.88	0.47
December "	37.8°	77°	-16°	33.2°	+4.6°	1.09	0.84	+0.25	1.48	1.08	0.71
January 1942	30.3°	72°	-27°	29.8°	+0.5°	0.37	0.69	-0.32	0.57	0.32	0.22
February "	32.3°	72°	-17°	33.0°	-0.7°	1.17	1.00	+0.17	1.78	1.07	0.65
March "	44.4°	83°	11°	43.4°	+1.0°	1.45	1.43	+0.02	1.51	1.65	1.18
April "	58.1°	94°	17°	54.6°	+3.5°	4.47	2.57	+1.90	4.05	4.32	5.03
May "	63.9°	102°	28°	64.0°	-0.8°	2.53	3.60	-1.27	4.42	2.52	0.85
June "	72.7°	102°	40°	73.8°	-1.1°	6.49	4.01	+2.48	7.58	7.34	4.54
July "	80.6°	111°	48°	79.2°	+0.8°	2.25	3.11	-0.86	2.66	1.93	2.15
August "	76.9°	108°	48°	77.9°	-1.0°	4.57	3.17	+1.40	5.80	4.74	3.18
September "	66.6°	100°	21°	69.8°	-3.2°	4.48	2.83	+1.65	6.87	4.82	1.74
October "	57.8°	95°	10°	57.3°	+0.5°	2.80	1.98	+0.82	2.61	2.97	2.83
November "	45.4°	87°	- 3°	43.2°	+2.2°	0.75	1.29	-0.53	1.58	0.45	0.21
December "	32.4°	73°	-11°	33.2°	-0.8°	1.32	0.66	+0.96	2.76	1.74	0.97
Average extremes or totals for 1942	55.0°	111°	-27°	54.9°	+0.25°	33.15	26.73	+6.42	41.99	33.15	23.55

the ninth wettest August since 1887 and the second coolest in nine years. There were several violent storms and some rivers overflowed.

September was one of the wettest and coolest on record. Killing frosts occurred on the 24th, 26th and 27th in various parts of the state. These dates are exceptionally early and caused considerable damage to late corn and sorghums. There was also more cloudiness than usual.

October had temperatures and rainfall slightly above normal. Rains were more frequent than usual but there were ten days of Indian Summer following the 4th. It was a fine month for wheat and fall pastures.

November was characterized by mild weather, rather light but somewhat deficient precipitation and excessive cloudiness. It was a good month for wheat and corn husking.

December was one of the wettest and cloudiest Decembers on record. The snowfall which totaled 10 to 15 inches in many places averaged 9.8 inches for the state was almost a record and the temperature averaged below normal. All parts of the state had an excess of precipitation. Only four years in 56 had greater amounts.

The year 1942, as to weather, was cool and wet, with a cold late spring and an abnormally early killing frost. The fall was wet with less than normal amount of sunshiny weather.

Crop Production Summary for 1942.

Kansas farmers produced the second largest crops on record in 1942 according to the Federal and State crop summary.

Production was 21 percent above 1941 and 74 percent above the five-year (1936-'40) average.

The wheat crop of 206,775,000 bushels, was the largest since 1931 when production totaled 251,885,000 bushels. The 19.5 bushels per acre wheat yield in 1942 has been exceeded only twice in Kansas history—in 1882 and 1914. Yields for the western half of the state exceeded all previous records while in eastern counties yields were far below average. Production of volunteer wheat was termed "most unusual".

Corn production was placed at 90,060,000 bushels compared with 57,224,000 bushels in 1941 which was the largest crop since 1932. The 28.5 bushels per acre yield was the highest since 1915 when the average was 31 bushels.

Estimates on other crops: Oats—46,232,000 bushels compared with 38,856,000 bushels for the preceding year—the largest production since 1920 except in 1941.

*From Kansas 1942 Crop Review. Kans. State Bd. of Agr., Agricultural Statistics Division, Dec. 20, 1942. Mimeographed Release.

Barley—17,186,000 bushels, compared with 26,520,000 last year.

Hay crops—All tame hay production was 2,059,000 tons, largest since 1928, compared with 1,556,000 tons in 1941.

Sorghums—18,124,000 bushels total for grain, or 17 percent less than last year. Late September freezes stopped plant growth earlier than usual and resulted in serious damage.

Soybeans—2,544,000 bushels, more than four times last year's crop and exceeds the combined production of all previous years.

Flaxseed—1,785,000 bushels or 56 percent above 1941 production and the largest crop since 1891.

Potatoes—754,000 bushels this year and 406,000 last.

Peaches—37,000 bushels compared with 44,000 in 1941.

Pears—144,000 bushels and 98,000 bushels last year.

Grapes—2,900 tons as against 2,100 in 1941.

Rye—1,287,000 bushels as against 979,000.

Broomcorn—1,900 tons this year and 3,100 last.

Alfalfa seed—134,000 bushels compared with 150,000 last.

Sweet clover seed—90,000 bushels and 109,000 last.

Lespedeza seed—9,100,000 pounds this year, 9,200,000 last.

Weeds were exceptionally plentiful in Kansas as well as in nearby states in 1942. Rats were more plentiful and destructive than for some years. Flocks of starlings became more common in eastern Kansas and through Missouri. Purple martins succeeded in rearing their full broods to flight before the hottest weather and with less loss than for a number of years.

Descriptive Account of the More Important Insect Activities and Climatic Relationships during 1942

Ants appeared to be normal in population during 1942. They were more widely reported in the questionnaire but the scores were almost wholly 1's and 2's. There were more 3's and 4's in 1941 than in 1942.

The yellow ant caused the usual number of inquiries during March.

Army worms were more plentiful in 1942 than for several years. The larvae were observed fairly plentiful in June in Riley County. The wheat head army worm did some actual damage to wheat which had gone down, but this species was less numerous and destructive than in 1941.

Aphids in general were not particularly abundant nor destructive during 1942. Several species threatened severe damage but they were thwarted largely by natural forces.

The green bug developed into a devastating outbreak in Texas in January and February and in Oklahoma in March. There was every

Table III. Population summary of the more common and important insects in Kansas for 1942, as indicated by 258 questionnaire score sheets from nearly all counties.

Key—

1. Scarce.
2. Plentiful but no noticeable or reported damage.
3. The species was abundant. Some damage was seen or reported.
4. Local outbreak. The species was doing severe damage in certain fields.
5. The species was in general outbreak. The insects were doing their greatest damage or were as plentiful as they ever get in a locality.

indication in late March or early April that this species would continue its destruction of wheat beginning at the southern border of Kansas and continuing entirely across the state. However heavy general rains fell on April 6 to 8 throughout this area and in southern Kansas which checked these aphids completely. The cool weather up to the rains favored the species. It was as expected that they attacked sown wheat instead of older and thicker volunteer wheat. The parasites began to build up in Oklahoma and by April 20, the outbreak to the south was on the decline and the threat was entirely over by the 28th.

First reports of green bug damage in Kansas came from Cowley Harper and Sumner counties. Somewhat more important damage occurred in Meade county and the Arkansas Valley which reflects its western distribution to the south. By mid-April, the greenbug was readily found in Riley and many other counties but were neither numerous nor damaging. Roy Fritz found them in mid-April in Harper, Barber, Comanche, Clark, Sedgwick, Sumner and Ford counties. Parasites and lady beetles built up to effective numbers and wheat made rapid growth during April which eliminated this threat and no real damage occurred in the state.

This species again occurred in fall sown wheat in October. R. H. Painter reported it apparently increasing during autumn.

Corn leaf aphids were plentiful during the fall in some fields in 1942. D. A. Wilbur reported the species as more plentiful in corn and sorghum in the western half of the state than for several years. R. H. Painter observed many molted skins and aphids of this species killed by a black fungus on tassels of these crops in north central Kansas during October.

Pea aphids increased rather slowly during the spring and reached fairly large numbers by May but alfalfa made such rank growth that

the aphids did little commercial damage. A few aphids were found in Pawnee county in early March and in Riley county in April. By mid-April, they were plentiful but growing conditions for alfalfa were excellent and the crop easily outstripped the aphids. They were reported on peas in Kiowa and Stanton counties.

Some foliage damage and stunted plants occurred in Pawnee, Harper, Finney, Ford, Kearney, Stanton and Meade counties. Stunted plants were reported from Geary, Wilson, Barton, Reno, Anderson and Wyandotte counties. Some alfalfa was cut in Riley county May 1 to check the aphids. Lady beetles were plentiful everywhere in April. Rains about the middle of May caused a sharp decrease in numbers of pea aphids and the spring pea aphid threat to alfalfa was over.

This species was readily found in alfalfa in the fall but it was neither seen nor reported in large numbers.

Aphids on roses and tulips were common in Riley county during April, requiring control efforts to protect the plants.

Snowball aphids were readily found but did minor curling of leaves in April.

Elm leaf aphids were less numerous and less troublesome than for several years.

Aphids on cucumbers and cantaloupes were reported at 3 from Ellis, Marshall and Riley counties; on garden crops at 4 from Barber, at 3 from Kingman, at 2 from Cloud counties; on roses from Riley and Marshall counties at 3; on corn from Marshall county at 2; on elms from Kiowa county at 3; on hard maples from Douglas county at 4 and on tulips from Riley county at 3.

Bagworms on evergreens, apple and willows were distinctly more common and more widely distributed in 1942 than in 1941. They were reported as particularly abundant in northeastern, southeastern and Kaw Valley counties. This insect appears to be on the increase in the entire eastern half of the state, especially the eastern fourth.

Bees produced little more than half a crop of honey in 1942 in spite of an excellent growth of sweet clover. Rains and cloudy weather prevented flying activity in early June when the colonies had peak population. When the weather cleared, white clover did not appear to produce as much nectar as was expected. Many beekeepers had more than usual difficulty in maintaining queens and success with requeening. There was a short, intense nectar flow during August and colonies built up their numbers on it. Then the nectar flow ceased and the colonies greatly reduced their winter stores. Some colonies went into winter with small stores of honey.

Blister beetles apparently declined in numbers during 1942. They

were reported from fewer counties and rarely scored higher than 3. Some damage particularly to gardens was done however in Finney, Scott, Morton, Ellis and Saline counties. Blister beetle injury to soldiers during field activities was reported during the summer. The decline no doubt corresponds to the small grasshopper population since the blister beetle larvae feed on grasshopper egg pods.

Borers in trees, particularly the flat headed borer, continued the decline in numbers and injury over 1941. They were scored at 1 to 3 generally which situation is believed to be about normal or average. Severe damage (scores of 4) was reported for Sherman, Kiowa, Cloud, Clay, Wabaunsee, Reno, Harvey, Labette, Crawford and Wyandotte counties. Damage to elm was reported from Ellis and Geary counties; to ash from Wabaunsee; to maple from Harvey; to fruit trees from Kingman, Harvey and Cowley counties; to hedge in Cowley county and to peach in Riley county.

Boxelder bugs continued at virtually the same large population in 1942 as in 1941. They were exceptionally plentiful during the spring and an almost equally large population went into hibernation in the fall.

Bot flies were somewhat more widely reported for 1942 than in 1941 but the numbers and injuries were probably closely comparable with 1941. A virtual epidemic of flies in July was reported for Lyon county.

Cabbage worms appear from the questionnaire reports to have been more numerous and destructive in 1942 than in 1941. While they are always a problem to gardeners they were scored from twice as many counties as last year and with 4's predominating. The increase in the number of gardens and renewed interest in gardening because of the war was probably a factor in the 1942 reports.

Canker worms while apparently less numerous in 1942 than in 1941 again caused widespread defoliation of elms and hackberry trees along creeks and woods in the state from Jewell and Mitchell counties eastward. Banding and spraying have reduced them to small numbers in many cities as in Manhattan for example. L. C. Aicher reported severe defoliation of hundreds of trees in the country in Ellis county. The trees soon put out new leaves and the growing conditions were generally favorable to the trees. Cankerworms were reported for fewer counties than in 1941 but severe damage was recorded for Decatur, Ellis, Osborne, Rice, Reno, Harvey, Butler, Cowley, Labette, Lyon, Wyandotte and Atchison.

The moths began emerging in Riley county about February. All of the fall species were out by March 1. The larvae were about half grown by May 1 and leaf destruction was beginning to be apparent.

Cactus insects reduced cactus to the smallest numbers in years. Many pastures were virtually cleared of cactus chiefly as a result of insect attacks. The cactus leaf bug, *Chelinidea vittiger* Whl., appears to have been the chief factor. Decay which may envelop the entire plant follows feeding by these bugs. The moth borer, *Melipotis* appeared to be less plentiful than in 1941. The cochineal insect, a mealy bug, occurred rather widely on cactus in Kansas during 1841. This is believed to be a first report of its presence in numbers.

Cattle grubs were scored somewhat higher and reported from more counties in 1942 than in 1941. The publicity given to cattle grub control campaigns may be in part responsible for more reports. These pests appeared to be plentiful in all but the southwestern quarter of the state. Approximately 3000 farmers applied derris for cattle grub control to 50,000 cattle during the winter of 1941-42.

Colorado potato beetles were the scarcest for many years. Some growers in the Kaw Valley and most gardeners around Manhattan did not apply insecticides this year for them and the foliage damage was negligible. Some dusting to protect the crop was done in early June when potatoes were in bloom. Observations indicated that only isolated potato plants were defoliated. At digging time, pupa of this species were plowed up in noticeable numbers.

Cedar scales were less numerous than in 1941 but they continued to attract attention. According to G. A. Dean, *Cryptaspidiotus shasta* Coleman is now found especially in wild, red cedars as far west as Phillips, Rooks, Edwards and Barton counties. It appears in practically all counties east of Phillips and Russell and north of the Republican and Kaw rivers. According to H. B. Hungerford, it is found in the following counties south of these rivers: McPherson, Marion and Douglas.

Lecanium fletcheri=*L. corni*, according to H. B. Hungerford, is known to occur practically all over the state. It has been abundant enough on juniper to require some attention at Pratt, Great Bend, Pawnee Rock, Larned, Kingsley, Mount Hope, Kingman, Belle Plaine and Independence. Specimens from Kansas City, Lawrence, Ottawa and Topeka have been seen.

Pseudococcus juniperi was reported by Hungerford damaging cedars at Pratt, Haviland, Greensburg, Medicine Lodge, Great Bend, Hillsboro and Dodge City.

Chiggers were again abundant and annoying over all but many of the extreme western counties, but the evidence indicates that they were less plentiful than in 1941. A single sulphur dusting in many lawns in Manhattan largely disposed of them for the season. There

was a slight reduction in the letters of inquiry and newspaper articles about chiggers over the previous year.

Chinch bugs early appeared threatening in the eastern half of the state but little damage was done and the reports showed them to have declined in numbers from 1941. The rains before and at harvest were distinctly unfavorable to them. Many nymphs were destroyed before they left the wheat fields by the heavy rains of May, June and July. Migration to corn was slow and periodic. Milo sorghum was damaged in several central counties.

The county agents reported that 696 farmers made creosote barriers against chinch bugs in 1942 and 4,942 combatted chinch bugs by some method. More preparation had been made than usual to keep chinch bugs under control in 1942 but the cool wet weather was so unfavorable to them that little artificial control was necessary. Fourteen large oil tanks were filled with chinch bug oil as a part of the precautionary program but little of it was used.

The fall survey indicated that fewer adult chinch bugs went into hibernation than in recent years.

Codling moths apparently increased somewhat in numbers and injuries in 1942 over 1941. This was probably due to poorer spraying as a result of the labor, insecticide and spraying equipment situation related to the war effort. The moths emerged on May 13 and the first cover spray was put on beginning with May 23.

Columbine leaf miners were exceptionally numerous and destructive in older columbine plantings.

Corn ear worms were somewhat less plentiful than in 1941. The damage to the corn crop was typical and normal. Infested sorghum heads were abundant particularly in the western half of the state during the fall. Corn ear worms were neither unusually plentiful nor destructive to alfalfa or tomatoes during the year.

Cucumber beetles, in common with other garden insects, were more widely reported in 1942 than in 1941 and the damage done was perhaps slightly greater. There were many reports of plantings being completely ruined but in general these pests were somewhat less numerous and destructive than during the drouth years.

Crickets were distinctly less numerous and annoying in homes during 1942 than in 1941. The cooler and more moist season kept them outdoors. Fewer reports were received of damage to alfalfa seed.

Cutworms were clearly less numerous and destructive in 1942 than in 1941. They were less extensively reported and the scores were lower. There were a few army cutworms, notably at Oberlin

in March but the garden species occurring in April and May were most commonly indicated. They were plentiful in Riley, Reno, Decatur, Kingman and Ellis counties.

The pale western cutworm was apparently present in the region of Graham county.

Wheat was damaged in Comanche county in June, probably by the wheat head army worm.

Fall army worms were present chiefly in the eastern half of the state but in smaller numbers than in 1941 and no damage of consequence was seen or reported. The larvae occurred in alfalfa fields but their presence in gardens in Ellis county was reported.

Fleas on dogs, cats and hogs were definitely more plentiful and annoying in 1942 than in 1941. They were scored higher and there were more reports of them than in 1941. While they were troublesome in all parts of the state, the reports indicated the largest population in the northeastern fourth of the state. The damp weather apparently favored them as they reached a peak, judging by correspondence in early July.

Flies which always fluctuate widely and suddenly in the state were definitely more plentiful and annoying during 1942 than in 1941. The ample rains provided favorable propagating places for them and several peaks in numbers were attained. They were scored at 3 to 5 in all parts of the state. They were in outbreak during June and July.

House flies were not listed specifically on the questionnaires but they were quite generally reported and scored at 2 to 5 over all of the state except some far western counties. Goertz reported them as worse than usual in Seward county.

Screw worm flies were slightly more numerous and more widely distributed during 1942 than in 1941. This species was reported as being in virtual outbreak in Comanche, Cowley, Harper and in some southeastern counties in April. These flies were reported as commonly appearing first each year around railroad feeding yards such as occurs at Arkansas City, Herington, Emporia and Manhattan.

Garden webworms were slightly more numerous in 1942 than in 1941 and were more widely distributed. However there was little damage by them seen or reported.

Grain insects were fully as numerous and widespread in 1942 as in 1941. The scorings for the first half of the year were slightly higher than for the last half.

An abundance of rain at harvest time resulted in much of the grain going into storage with a relatively high moisture content. In

this condition it is highly susceptible to infestations by insects. Grain inspection records indicate that insect infestation in commercial shipments of grain was fully as severe in 1942 as in the preceding year which with the exception of 1939 was classed as one of the worst years on record.

The insects most abundant in farm-stored grain in Kansas and causing most trouble was the lesser grain borer, the rice weevil, the flat grain beetle, the rust red flour beetle, the cadelle and sawtoothed grain beetle.

Grasshopper populations declined during 1942 to the smallest numbers in about ten years. The fall survey in 1941 indicated that grasshoppers would not be so numerous in 1942 as they had been in 1941. The spring opened late with grasshopper eggs somewhat delayed in hatching. By the middle of May, there was a 60 percent hatch. The weather changed from dry to wet and from that time on until late summer the grasshoppers had plenty of grasses and weeds to feed upon. They caused little damage to crops in general.

The rains during the fall of 1941 apparently interfered with grasshopper egg laying and the cold, wet spring was unfavorable for hatching. The first brood appeared late and the wet June further retarded their growth.

Fall sown wheat required little baiting to protect it from invading grasshoppers. In the central and eastern counties, grasshoppers caused a little damage to alfalfa and the newly sown alfalfa.

The damage to wheat and barley was light in all areas. Slight damage occurred to corn in northwestern counties. The damage to fall sown wheat in 56 western counties was light. In general the crop injury by grasshoppers was the lightest since 1932. Most of the poison bait was applied in the four northwestern counties.

Grasshopper bait sowing was less general than usual. The county agents reported that 3,418 farmers sowed 423 tons of bait (dry weight) in 60 counties in 1942. The estimate of needs was 2,725 tons. The fall egg survey indicated that in general fewer than usual eggs had been deposited for the 1943 grasshopper population.

Harlequin cabbage bugs were present all summer in Riley county. H. R. Bryson reported some cabbage ruined by them and in early September, they attacked turnips.

Hessian fly populations in eastern Kansas increased slightly over 1941 but growing conditions were so favorable for wheat that an excellent crop was harvested. R. H. Painter summarized the hessian fly situation in 1942 as follows:

"Throughout 1941 weather conditions were favorable for Hessian fly development and the fact that farmers were encouraged to leave volunteer to grow aggravated the situation. At the beginning of 1942, wheat as far west as Reno and Phillips counties was fairly generally infested. In Sedgwick, Cowley, Wabaunsee and some other counties much wheat was killed by fly before or during the winter of 1941-42. In Sedgwick county in February, the county agent reported 40 to 50 flaxseed per square foot in some fields. In the area severe infestations extended as far west as Mayfield in Sumner county. In southeastern Kansas, the fall of 1941 infestation killed volunteer in some places and early planted wheat was almost universally infested. Barley carried some infestation also. Many farmers in this area waited until after the safe seeding date and were prevented by weather conditions from planting wheat after that time.

"In the spring of 1942 the first eggs were seen at Manhattan April 10 and the eggs of the second brood were abundant May 27. The spring infestation was found at least as far west as Mitchell and Kingman counties with severe damage in some areas. An infestation was also reported in Cheyenne county by J. H. Parker. The heavy June rains caused much lodging in the wheat and thus fly injury was less apparent than it would otherwise have been. In some areas a summer generation occurred on early volunteer in July but in this area a general infestation did not occur until late in September, and it was light or absent in wheat planted after the safe seeding date. Infestation was heavy in seeded wheat in Clay, Cloud and Reno counties and present at least as far west as Phillips. In the northeastern part of Russell county, a light infestation was found only in volunteer among stubble of last year's volunteer. Apparently the fly was killed by the drouth of the thirties in most of southwestern Kansas and is now returning slowly westward."

The heavy loss to wheat by this insect in 1941 suggested a control campaign for the fall of 1941. A result of the publicity campaign in 52 eastern counties was that more than 30,000 farmers waited for the safe-seeding date to plant wheat and many were caught by the rains with no wheat planted. It was estimated by the State Bureau of Crop Estimates that about 1,000,000 acres did not get planted to wheat on that account. The Hessian fly thus was blamed for the loss. Many farmers however, planted their crop before the heavy rains and some during the drier times between rains. Most of that wheat was heavily infested and some of it was total loss. Of the early and late planted wheat, it was estimated that the loss totaled about 6,000,000 bushels both in the fall and spring. The land that was not planted to wheat in the fall of 1941 was mostly planted to soybeans, corn and sorghum.

Lice on cattle were observed to be somewhat more plentiful and annoying than usual during the spring and fall. These pests persisted in numbers well up into June which is longer than usual due probably to the cool wet spring. Sucking lice were reported as abundant on calves during October.

Hog and chicken lice were observed and reported to have been somewhat more numerous than usual in the Kaw Valley counties during April.

Maple worms injury to maple foliage was observed early in July in counties north and east of Shawnee. The defoliation appeared to be no more severe than usual however.

Mosquitoes occurred in several well defined peaks as a result of the rainy seasons. They were abundant during June and August to October inclusive. They were especially annoying in mid-September in Riley county.

Potato tuber moths were not found in the state though scouting trips were made by state and federal officials in the potato districts to look for it.

Rose sawflies were rather scarce and inconsequential in the spring of 1942. The few reports of them were largely from the Kaw Valley and south central counties. While brown rose foliage commonly resulting from rose sawfly feeding was common, favorable growing conditions quickly enabled the plants to recover.

Rose bud worms were scarce and below the numbers of 1941.

Sheep ticks or keds were emphasized in extension publicity and about one-fourth of the more than 600,000 native sheep were dipped for keds. It is doubtful whether these insects were more plentiful in 1942 than usual.

Southern corn root worm (*Diabrotica 12-punctata*) were apparently more numerous and destructive during 1942 than for several years. The adults were extremely common all summer and the larvae were repeatedly reported damaging young corn. Injuries were reported especially from the Kaw Valley.

Southwestern corn borer (*Diatraea grandiosella* Dyar) population and damage to corn was the outstanding entomological event of 1942. D. A. Wilbur summarized the situation as follows:

"The southwestern corn borer, *Diatraea grandiosella* Dyar continued its sweep northward across Kansas during the 1942 growing season and has been found within 20 miles of the Nebraska border in Phillips county. This insect was first observed in Kansas in the

southern portion of Morton and Stevens counties in 1931. It was checked and probably eliminated in this section by the years of excessive drouth. The insect was not reported again in Kansas until the fall of 1941 when it was found to occur in at least 29 counties of the southwestern quarter of the state. There was some evidence to indicate that the borers may have been present in some fields in Kansas during 1940. During the 1942 growing season an additional 22 counties were found to be infested making a total of 53 infested counties. Further surveys would doubtless have added another eight to ten counties to this list.

"The most heavily infested area includes a north-south strip of about 90 to 125 miles wide, the center of which extends on a direct line from Comanche to Ellis counties. There are sections within this strip where it was difficult to find an uninfested field of corn. Field heavily attacked by the first generation of borer showed damage from "dead heart" stunting, bushing and riddled stalks in addition to the girdling of the stalks by the larvae in their preparation for hibernation. Over certain areas the corn was attacked only by second generation borers which had migrated in as adults from other counties. Many of these fields suffered damage by girdling. In one field of 160 acres there was approximately 22 1-2 bushels of corn per acre on the ground after the picking machine had been over the field.

"A survey made during January 9 to 15 indicated that approximately 70 percent of the infested stalks were occupied by live borers. This strongly suggests that a large population of moths will be present to infest the 1943 corn crop."

Stalk borer infestation in wheat was more conspicuous than usual in the central third of Kansas according to observations made by R. H. Painter. This was particularly noticeable next to weedy fence rows.

Strawberry leafrollers were plentiful in May but under the favorable growing conditions less damage than usual resulted.

Strawberry sawfly damage was serious in northeast Kansas the latter half of April, according to R. L. Parker. The foliage in some fields was severely damaged.

The sweet clover weevil (*Sitona cylindricollis* Fabr.) has not yet been found in Kansas in spite of a careful watch for it. This beetle has spread westward to Montana and has been taken in Nebraska and Missouri.

Termites were favored by the rains and were readily found in boards on the surface of the ground practically all summer. Inquiries

*Wilbur, D. A., Bryson, H. R. and Painter, Reginald H. A major outbreak of the southwestern corn borer in Kansas. Jour. Econ. Ent. 35 (6): 938-939: Dec: 1942:

about their control were no more common than in previous years and the scorings would indicate a slightly lower population and less injury than in 1941.

Tomato horn worms were slightly more numerous in 1942 than in 1941. They were also reported for more counties. In Riley county they were observed to have been scarce in numbers and of less consequence than usual.

Wheat stem maggots were reported by R. H. Painter to have been particularly abundant in early September in volunteer wheat. They were reported to be more abundant than usual in Dickinson, Saline, McPherson, Harvey, Sumner, Cowley, Marion, Butler, Morris, Chase, Pottawatomie, Clay, Washington, Marshall and Riley counties by the Extension Entomologist. White heads were plentiful at harvest time also but the loss was small.

Wheat straw worms in wheat were clearly more plentiful and destructive in 1942 than for several years. The weather apparently favored them. Many scores of 2 and 3 were reported from the leading wheat growing counties of the state.

Webworms occurred in numbers approaching an outbreak and caused some foliage damage to soybeans in July and to alfalfa in August in eastern Kansas. Young soybeans were killed or severely damaged in many fields. The damage was reported particularly severe in Lyon county.

White grubs were plentiful in 1942 but growing conditions over the state were so favorable that very little noticeable injury was done. They were scored at 1 to 3 by reporters in most counties and a final summary of 2 was generally recorded. White grubs were reported as fairly injurious around Kingman.

Wireworms were slightly more numerous and destructive in certain areas in 1942 than during last year. The summary scores are mostly 2's and 3's with a few 4's. They were especially noticeable in the counties around Riley, in the northeastern counties and south central counties. Some wireworm damage to muskmelon seeds occurred during May in Riley county. Reports of wireworm injury in northwest Kansas probably referred to false wire worms instead.

Summary and Conclusions

The year 1942 was nearly normal as to temperature and with the exception of 1915, it was the wettest in Kansas since weather records were started in 1887. June was the wettest June in 13 years, September the fourth wettest and October by far the wettest tenth month. Pittsburg had 63.11 inches during the year, one of the largest annual totals ever recorded in Kansas. The smallest total was 24.17 inches at Leoti which was 50 percent above normal. Although

a fine crop year it was the worst the state has had for floods. The spring was cool, wet and late and the summer was mild, the early fall was wet and had about normal sunshine but there was an excess of cloudiness for the last two months.

Crop production in Kansas in 1942 was the second largest on record, being exceeded only in the year 1931. Although the acreage in crops was decreased about 1.4 percent this year the 1942 production was 21 percent higher than last year and was about 74 percent above the 5 year (1936-40) average. The outstanding high yields of 1942 were made possible by a combination of unusually favorable weather and war-time demand that called for maximum effort and insured a market for practically everything that farmers could produce. Growing conditions were unusually favorable throughout the state. Crops and ranges were benefitted by the subsoil moisture remaining from the exceptionally heavy rainfall of 1941 and were helped along by the above normal rainfall of 1942. The wheat crop was second only to 1931, the largest corn crop since 1932, a hay crop larger than in any year since 1928, flax production the largest since 1891 and a soybean crop more than 4 times the production in any previous season.

The following insects occurred in **outbreak numbers** during 1942 in Kansas: canker worms; red cedar scales; stable flies; Hessian fly; mosquitoes; southwestern corn borer; garden webworms.

The following insects, ticks and mites were **more numerous in 1942 than in 1941**: army worms; green bugs; corn leaf aphid; aphids on tulips and roses; bag worms; bot flies; codling moths; striped cucumber beetles; imported cabbage worm; cattle grubs; house flies; stable flies; horn flies; screwworm flies; fleas on pets and in homes; stored grain insects; garden webworms; hessian flies; lice on domestic animals; mosquitoes; southern corn root worm; root worm beetles; tomato horn worm; wheat straw worms; wheat stem maggots; wireworms;

The following insects, ticks and mites were **approximately as plentiful in 1942 as in 1941**: ants; pea aphids; boxelder bugs; chinch bugs; chiggers; harlequin cabbage bugs; strawberry sawfly; white grubs.

The following insects, ticks and mites were **less plentiful in 1942 than in 1941**: wheat-head army worm; corn ear worm; elm leaf aphid, cucumber and melon aphids; blister beetles; tree borers; crickets; cutworms; Colorado potato beetles; fall army worms; grasshoppers; green striped maple worms; rose sawflies; strawberry leafrollers; red cedar scale; termites in homes and about living plants and false wireworms.

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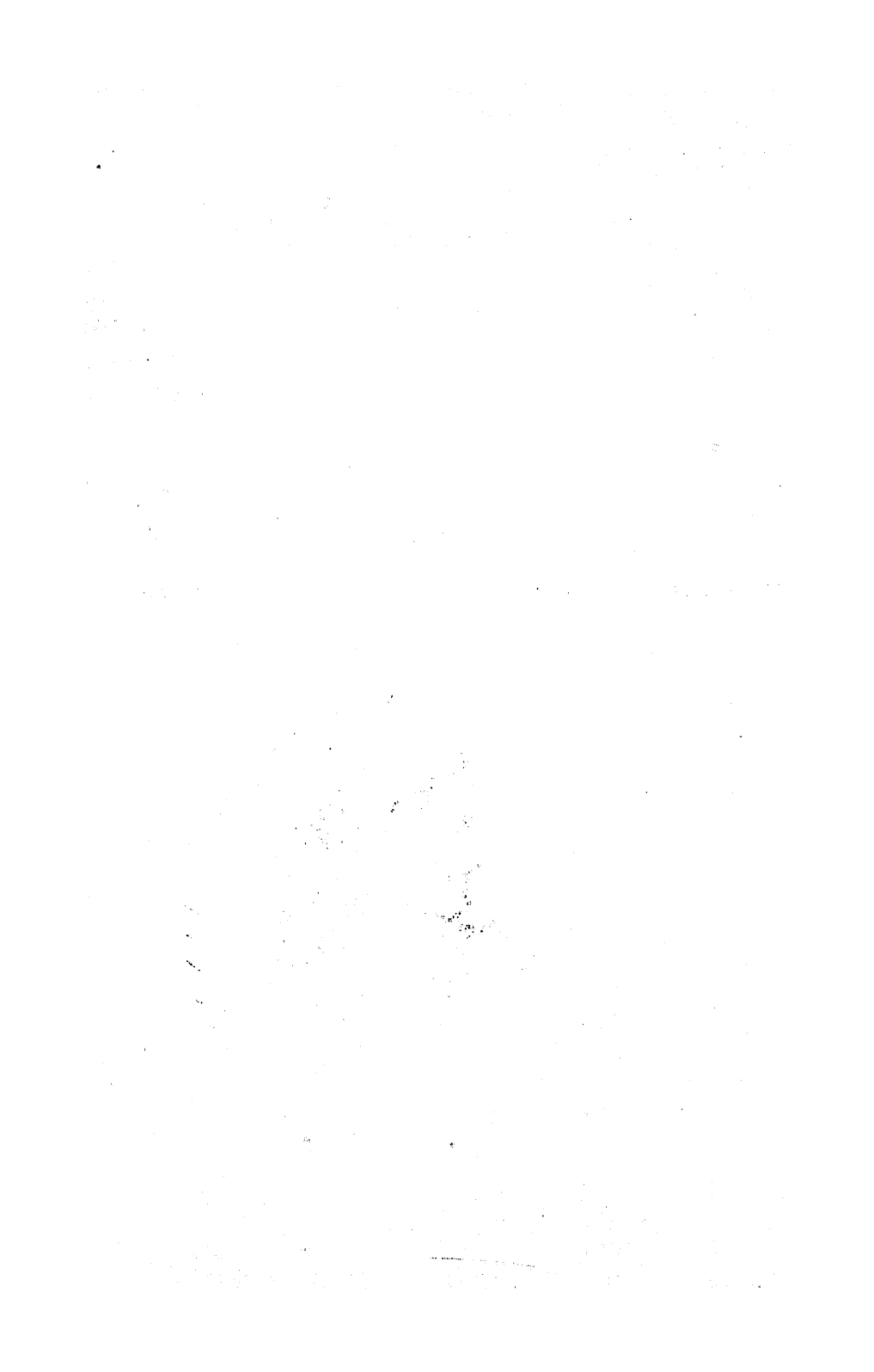
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A KEY TO THE CULEX (DIPTERA, CULICIDAE) OF THE SOUTHEASTERN UNITED STATES, BY MALE TERMINALIA.

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At the present time twelve species of *Culex* have been recorded from nine of the southeastern states, as shown in Table 1. These have been placed in three subgenera:

Culex:—*bahamensis*, *nigripalpus*, *pipiens*, *quinquefasciatus*, *res-tuans*, *salinarius*, *tarsalis*.

Neoculex:—*apicalis*.

Melanoconion:—*atratus*, *erraticus*, *pilosus*, *peccator*.

The males of the subgenus *Melanoconion* are so similar that they can be positively identified only by an examination of their genitalia. This is also true of the subgenus *Culex*, although in this group the external differences between some of the species are more distinct, and after some experience one may identify them by markings alone. However an examination of the genitalia is often necessary to identify positively the species of the genus *Culex*. This is particularly true of specimens which have been damaged in light trap collections.

The technique used in studying the genitalia is a simple one taken from King (unpublished). The last two or three segments of the abdomen are clipped off with a fine pointed scissors and transferred to 10% KOH. This is heated for three to five minutes, care

¹Grateful acknowledgement is made to Major S. J. Carpenter, Sn. C., and to Capt. W. W. Middlekauff, Sn. C., of the Entomology Department of the Fourth Service Command Medical Laboratory, for their many helpful suggestions.

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Table 1. Distribution of the species of *Culex* in the Southeastern United States.

Species	Recorded from ²									
	Fla.	Ga.	Ala.	Miss.	La.	Ark.	Tenn.	N. C.	S	C.
apicalis	x	x	x	x	x	x	x	x	x	
atratus	x									
bahamensis	x									
erraticus	x	x	x	x	x	x	x	x		x
nigripalpus	x	x	x		x					x
peccator	x	x	x	x	x	x	x	x	x	x
pilosus	x	x	x	x	x				x	x
pipiens		x	x				x	x		x
quinquefasciatus	x	x	x	x	x	x	x	x		x
restuans	x	x	x	x	x	x	x	x		x
salinarius	x	x	x	x	x	x	x	x		x
tarsalis					x	x	x			

being taken to prevent boiling. With the aid of a pipette the specimen is then transferred to distilled water and rinsed. Heating the water will help remove the remainder of the tissue. The chitinous structures remain undissolved. The specimen is then placed in a drop of glycerine on a slide, and dissected with a pair of *minuten nadeln* at the end of applicator or match sticks. It is best to use the high power of a binocular dissecting microscope for this procedure.

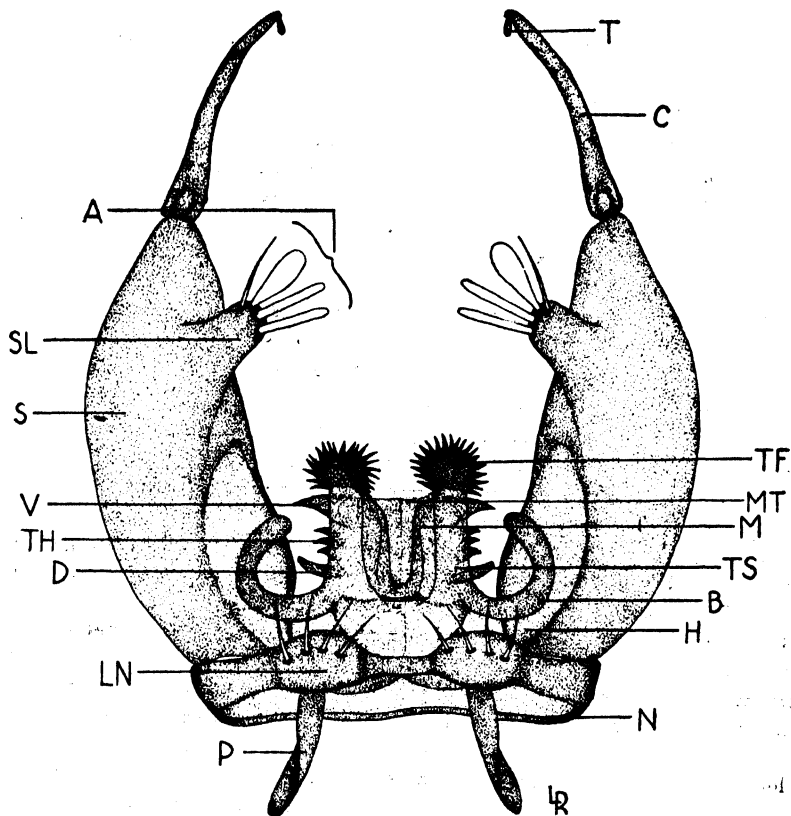
If a permanent mount is desired, the dissection may be made in a drop of chloral gum¹ and covered with a cover slip. In most cases it is well to separate the various structures so that they can be examined from all sides. In the present paper almost all of the figures were drawn from dissected structures which had been separated and mounted individually. Once mounted, the specimen should be examined under the low and high powers of a compound microscope to see all the details.

¹From King, Roth, Toffaleti and Middlekauff, 1943.

²The formula for chloral gum is:

Gum arabic (clear lumps or powdered)	8 gms.
Distilled water	8 c. c.
Glycerin	5 c. c.
Chloral hydrate	70 gms.
Glacial acetic acid	3 c. c.

(From King, Bradley and McNeel, 1942.)



A
Fig. A.

A diagrammatic drawing of a genitalia, more or less typical, of the subgenus **Culex** (Dorsal view).

A=appendages of the subapical lobe of the sidepiece; B=basal arm of the tenth sternite; C=clasper; D=dorsal arm of the mesosome; H=hollow of the sidepiece; LN=lobe of the ninth tergite; M=mesosome; MT=membranous portion of the tenth segment; N=ninth segment; P=plate of paramere; S=sidepiece; SL=subapical lobe of the sidepiece; T=terminal spine of the clasper; TF=tuft of the tenth sternite; TH=tooth on the mesosome; TS=tenth sternite; V=ventral arm of the mesosome.

(The setae and pilosity of the sidepiece have not been drawn; only one pair of paramere plates is shown.)

Figures of the genitalia of most of the species of *Culex* can be found in the literature (Dyar, 1928; Matheson, 1929; Rozeboom, 1942, etc.). However these are often drawn or photographed on too small a scale to show the important structures.

The following description of the genitalia (Fig. A) is more or less typical for the subgenus *Culex*. The other subgeneric differences are discussed in the key. Only structures which are actually used in the key will be described and most of these characters for the different species have been illustrated. Fig. A is drawn from the dorsal position. Shortly after emergence the male terminalia rotates 180 degrees so that the tergites are actually on the underside. If the specimen is mounted with the claspers up, the tergites are turned upwards and are in their proper morphological position. This is referred to as the dorsal side.

Those segments posterior to the seventh abdominal segment are considered as comprising the male terminalia complex. The genitalia (hypopygium) begins with ninth segment (N) which is a complete chitinous ring. The ninth tergites are more or less developed depending on tinous ring. The ninth tergites are more or less developed depending on developed lobes (LN) which are so distinctive that they can be used to differentiate species. A large pair of appendages, the sidepieces (S) are attached to the sides of the ninth segment. These sidepieces are hollowed (H) basally on the inner surface to house the other structures. A more or less prominent subapical lobe (SL) arises near the upper part of the sidepiece and bears several appendages (A) of various sizes and shapes. Herms (1939) states that this lobe is a projection of the interbasal fold that has migrated up the dorsal side toward the apex of the sidepiece. A long clasper (C) which usually ends in a small terminal spine (T) is articulated from the apical end of the sidepiece. Lying between the sidepieces and within the ring formed by the ninth segment are several important structures, one of which is the tenth segment. This arises from the ninth segment and is a membranous structure (MT) with two supporting pigmented arms, the tenth sternites (TS), each bearing a tuft (TF) or a row of spines. These spines are usually darkly pigmented and therefore very conspicuous. A fairly stout, curved or straight basal arm (B) may arise near the base of the tenth sternite, and in some species curves down and extends ventrally around the mesosome. The mesosome (M) or peneal sheath, the other of the important structures between the sidepieces, lies behind the tenth sternite, is very complex and quite distinctive in each species of the subgenus *Culex*. Each mesosomal plate often possesses a dorsal (D) and ven-

tral (V) arm and some forms have teeth-like (TH) structures arising from between these arms. Parameres (P) are present but have not been used in the key.

KEY TO THE SPECIES OF CULEX BY MALE TERMINALIA

1. Tenth sternite with an apical tuft of short bristles or spines (Figs. 4, 11, 14, 17, 21) ----- Subgenus *Culex* 2
 - Tenth sternite comb-shaped apically, with a row of fairly stout teeth (Figs. 26, 27, 30) ----- 8
2. Subapical lobe a prominent elevation arising at about the apical third of the sidepiece and bearing five to eight appendages; clasper with a small, rounded terminal spine; patches of setae lacking from both the sidepiece and the subapical lobe (Figs. 1, 9, 12, 15, 19) ---- 3

Subapical lobe fairly long and stout, thumb-shaped, arising from about the middle of the sidepiece and bearing three short stout apical rods, two of these with bent tips; a patch of broadened setae on the lobe below the rods, another patch of long slender setae at the base of the lobe and a third medianly outward on the sidepiece; clasper without a terminal spine (Fig. 23)

----- *Culex bahamensis*
3. Subapical lobe of sidepiece with eight appendages (Fig. 1); base of tenth sternite produced laterally into a blunt point or a short, nearly straight arm (Figs. 4, 5, 6); ventral arm of mesosome curved outwardly toward the sidepiece giving a wing-like appearance (Figs. 2, 7) ----- 4

Subapical lobe with five or six appendages (Figs. 9, 12, 15, 19); base of tenth sternite produced into a long, stout, strongly curved arm (Figs. 11, 14, 17, 21); ventral arm of mesosome, not as above ----- 5
4. Dorsal arm of mesosome, slender, somewhat pointed, lying at about right angles to the wings of the ventral arms (Figs. 2, 3) ----- *Culex quinquefasciatus*

Dorsal arm of the mesosome broad, semicylindrical in appearance, usually with a truncate tip; this arm placed obliquely and extending toward the tip of the ventral arm (Figs. 7, 8) ----- *Culex pipiens*

(In regions where both of these species are found, intermediate forms have been noted and at times it is difficult to identify positively either of these mosquitoes.)

5. Subapical lobe of the sidepiece with a distinct broad, flattened leaf (Figs. 12, 15, 19) ----- 6
 Leaf of the subapical lobe narrow, little if any wider than the rods; the other appendages of the lobe usually include two stout rods and two slender setae (Fig. 9); tenth sternites terminating in a crown of sharply pointed inner bristles and blunt outer ones (Fig. 11); ventral arm of the mesosome consisting of two median, vertical, blade-like processes; dorsal arm a stout tapering horn which originates from the base; several stout teeth between the two arms (Fig. 10)-----*Culex tarsalis*
6. Mesosomal plate with two arms and with a median row or group of short, fairly stout teeth (Figs. 16, 20)----- 7
 Mesosomal plate without a median row of teeth, the processes consisting of a short dorsal arm and a longer ventral arm which has a small tooth near the base (Fig. 13); subapical lobe of the sidepiece with three rods, a leaf, and two setae (Fig. 12)-----*Culex restuans*
7. Ninth tergite deeply cleft with fairly stout setae arising on the prominent angles (Fig. 18); eighth abdominal segment with a patch of small stout setae, somewhat centrally placed on the apical margin (Fig. 18); mesosomal plate with a stout dorsal arm and a long horn from near the base (Fig. 16); lobe of the sidepiece with a leaf, three rods, and a seta (Fig. 15); several spines on one side of the tuft of the tenth sternite short and bluntly rounded (Fig. 17) -----*Culex nigripalpus*
 Ninth tergite somewhat rudimentary, the central margin only slightly concave with a row of slender setae along the outer corners (Fig. 22); eighth abdominal segment without a patch of short stout setae; dorsal arm of the mesosomal plate short, bent in the middle at about a right angle, with a pointed tip (Figs. 20, 21); subapical lobe of the sidepiece with three rods, a leaf and two setae (Fig. 19); spines of the tenth sternite all sharp pointed (Fig. 21) ----- *Culex salinarius*
8. Subapical lobe of the sidepiece with a distinct division (Figs. 28 32, 33); mesosomal plate with a long, curved basal arm (basal hook), directed ventrally (except in *Culex atratus*) (Figs. 29, 30, 31) Subgenus *Melanoconion* 9
 (For figures of *Culex atratus* and the ninth tergite of other *Melanoconions*, see Roth and Young, 1943.)

Subapical lobe not distinctly divided and bearing two stout rods with curved pointed tips and several shorter serrated and pointed setae; the serrated setae stout and blade-like (Fig. 24); mesosomal plate without a basal hook, the apical end of each studded with small denticles and both halves joined near the top by a transverse bridge (Fig. 25); lobes of ninth tergite two widely separated knob-like elevations each studded with a few small setae (Fig. 27).---Subgenus *Neoculex*, *Culex apicalis*

9. Apical division of the subapical lobe of the sidepiece with a distinct broad leaf (Figs. 28, 33; Roth & Young, Fig. 1) 10

Apical division of the subapical lobe lacking an expanded leaf but with several rod-like filaments; basal division divided into two subequal arms, each with a long, stout, capitate filament at the tip; apical swelling of the clasper cap-shaped, tapering abruptly and with a hirsute upper margin (Fig. 32); lobes of the ninth tergite finger-like projections from the corners of a broad spicular plate, which has a central oval or irregularly ovate lacuna; one or two smooth setae on each lobe and several grouped on the posterior corners of the plate (Roth and Young, Fig. 7) ----- *Culex pilosus*

10. Clasper gradually tapered with very little apical swelling (Fig. 28; Roth and Young, Fig. 1) ----- 11

Clasper greatly enlarged apically with the outer and front margin of the expanded quadrangular portion hirsute, the stem stout and constricted near the middle; basal division of the subapical lobe with one arm bearing a stout filament at the tip and a second filament arising from about the middle of the stem; apical division of the lobe with a very large fan-shaped leaf on a short stem with one long and two shorter stout filaments, plus a fine seta (Fig. 33); lobes of the ninth tergite roughly triangular, approximate, the outer and lower margins and basal portion of each with long, smooth setae arising from conspicuous tubercles (Roth and Young, Fig. 6) ----- *Culex peccator*

11. Lobes of the ninth tergite ovate, prominent, with numerous smooth setae arising from prominent tubercles; numerous small spicules on the lower base of each lobe (Roth and Young, Fig. 5); apical division of the

subapical lobe with an expanded leaf, a long hooked filament, and several smaller filaments; basal division divided into two subequal arms, each with a long stout, capitate filament at the tip (Fig. 28) ----- *Culex erraticus*

Lobes of the ninth tergite somewhat pear-shaped with a number of barbed setae arising from the basal half (Roth and Young, Fig. 2); basal portion of the subapical lobe with an upper stout rod-like seta and a slender lower one from its base; apical division curved from the base of the basal with a broad ribbed leaf from its tip, behind which arises a stout recurved seta; two conspicuous slender setae arise on the outer side of the apical division each with a smaller, inconspicuous seta from near its base (Roth and Young, Fig. 1); mesosomal plate a stout, curved, simple blade--*Culex atratus*

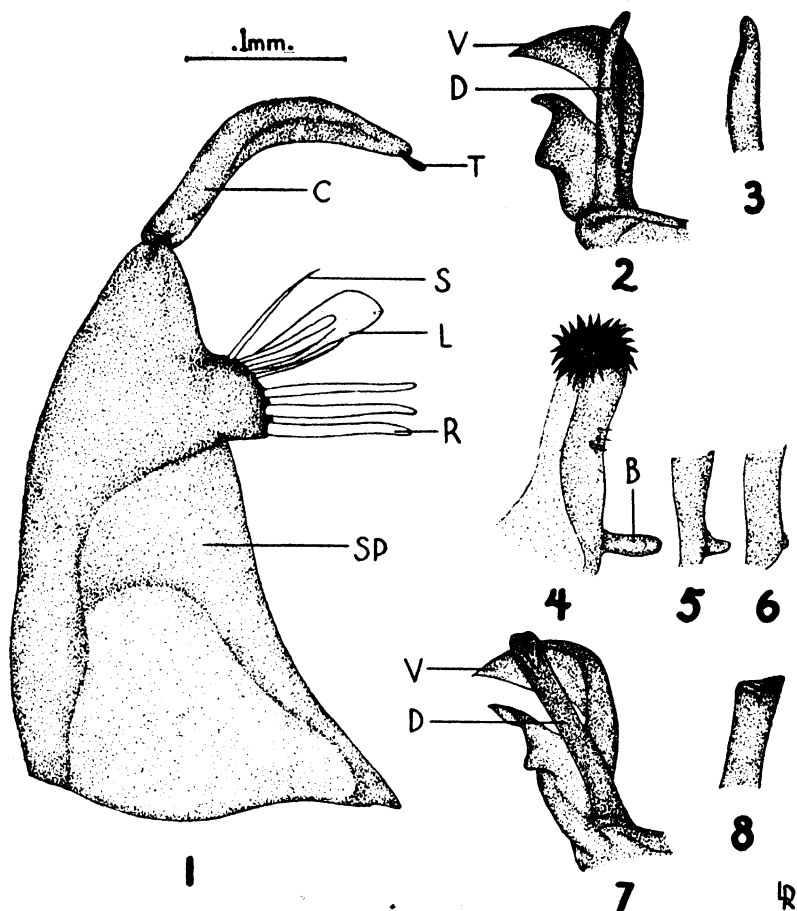
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PLATES

(Figs. 1-33)

All figures have been outlined with the aid of an ocular grid. Except for Figs. 25 and 27 only one side of the paired structure has been drawn. The outer margin and pilosity of the sidepieces have not been indicated. The sidepiece itself has been drawn on the lower surface.



***Culex quinquefasciatus* Say and *Culex pipiens* L.**

Fig. 1. Sidepiece of *C. quinquefasciatus*. (similar in *C. pipiens*). C=clasper; L=leaf; R=Rod; S=seta; SP=sidepiece; T=terminal spine.

Fig. 2. Mesosomal plate of *C. quinquefasciatus*. (dorsal view) D=dorsal arm; V=ventral arm.

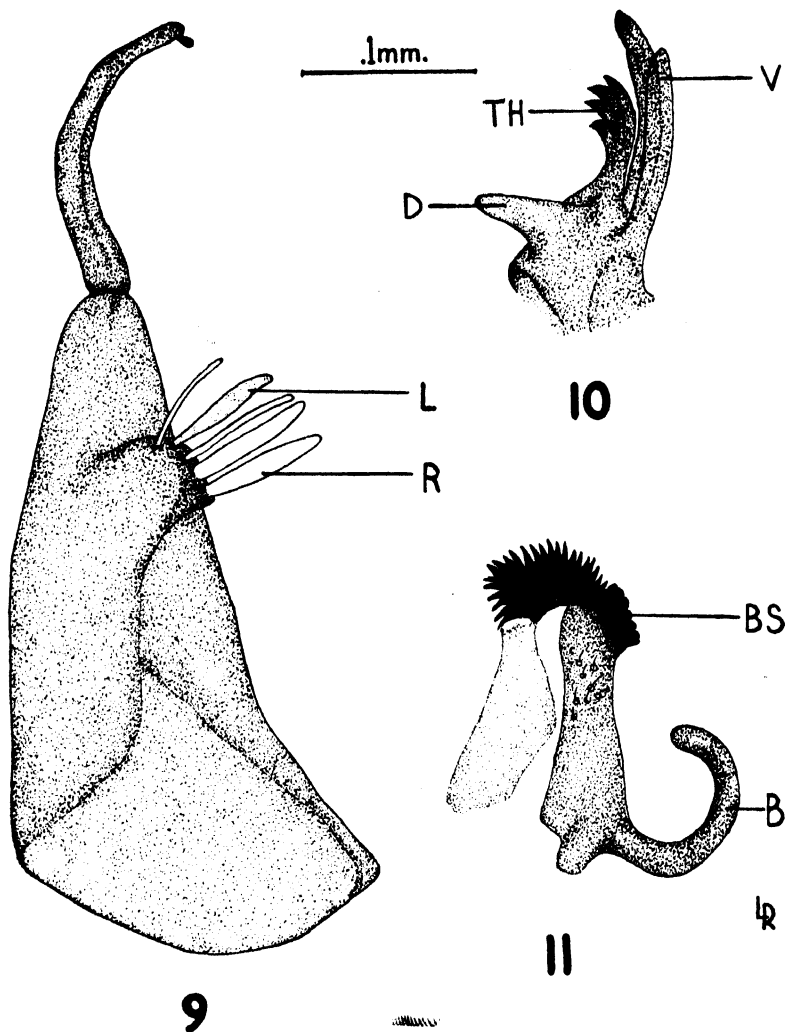
Fig. 3. Apical half of the dorsal arm of the mesosome of *C. quinquefasciatus*. (lateral view)

Fig. 4. Tenth sternite of *C. quinquefasciatus*. (somewhat similar in *C. pipiens*) B=basal arm.

Figs. 5, 6. Variations in the basal arm of the tenth sternite in *C. quinquefasciatus*. (somewhat similar in *C. pipiens*)

Fig. 7. Mesosomal plate of *C. pipiens*. (dorsal view) D=dorsal arm; V=ventral arm.

Fig. 8. Apical half of the dorsal arm of the mesosome of *C. pipiens*. (lateral view)

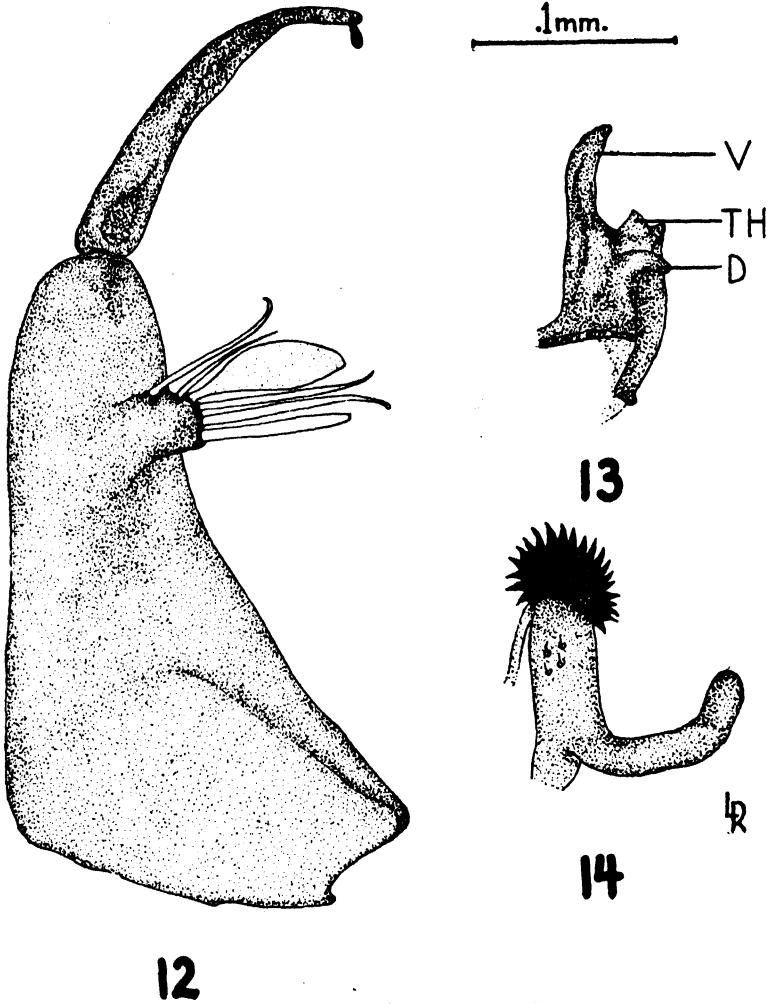


Culex tarsalis Coq.

Fig. 9. Sidepiece. L=leaf; R=Rod.

Fig. 10. Mesosomal plate. D=dorsal arm; TH=tooth; V=ventral arm.

Fig. 11. Tenth sternite. B=basal arm; BS=blunt spine.

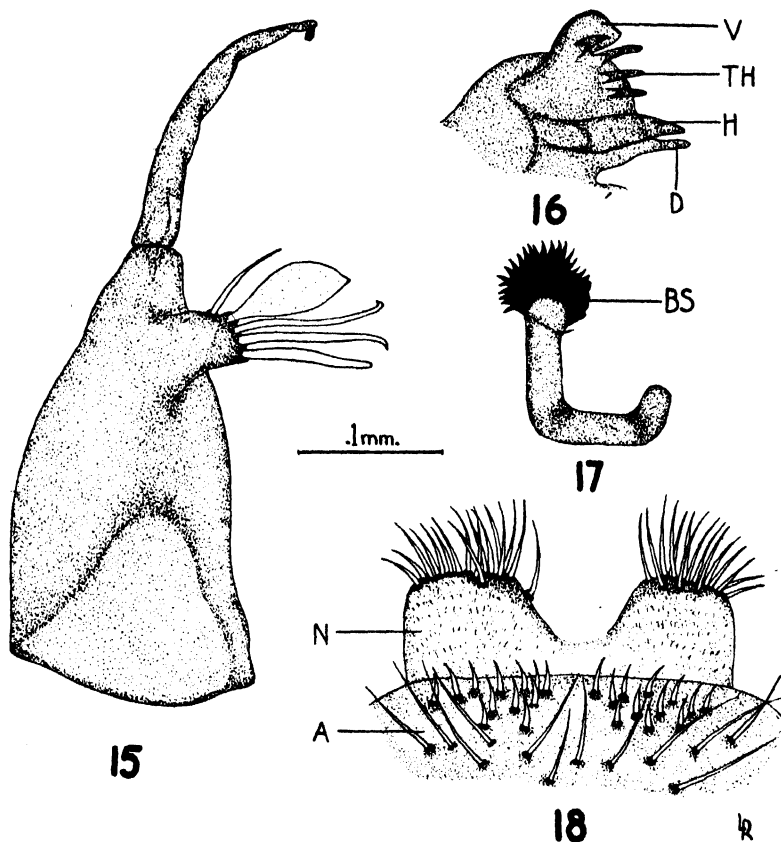


Culex restuans Theob.

Fig. 12. Sidepiece.

Fig. 13. Mesosomal plate. D=dorsal arm; TH=tooth; V=ventral arm.

Fig. 14. Tenth sternite.



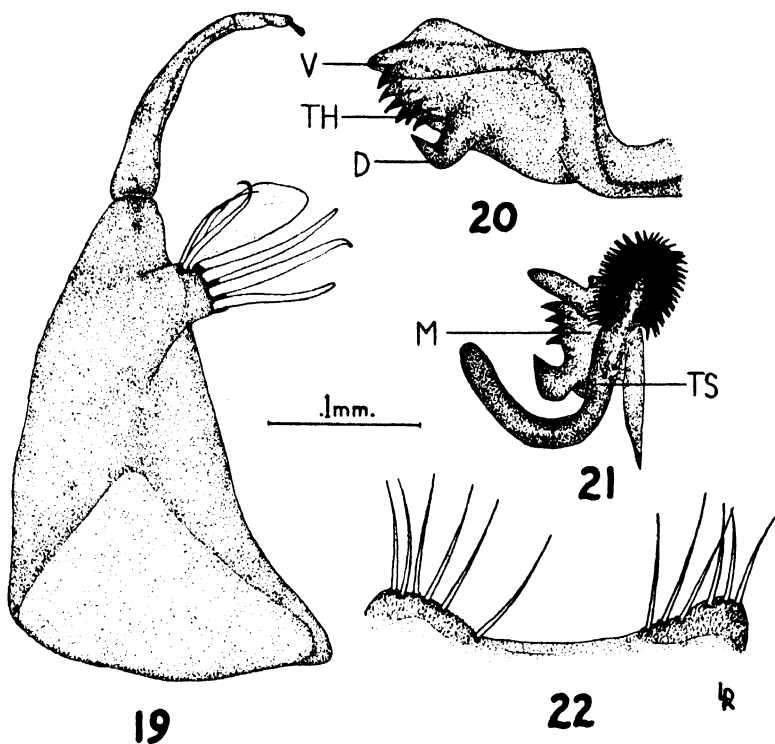
***Culex nigripalpus* Theob.**

Fig. 15. Sidepiece.

Fig. 16. Mesosomal plate. (lateral view; inner side). D=dorsal arm; H=horn; TH=tooth; V=ventral arm.

Fig. 17. Tenth sternite. BS=blunt spine.

Fig. 18. Ninth tergite (N) and eighth abdominal segment (A).



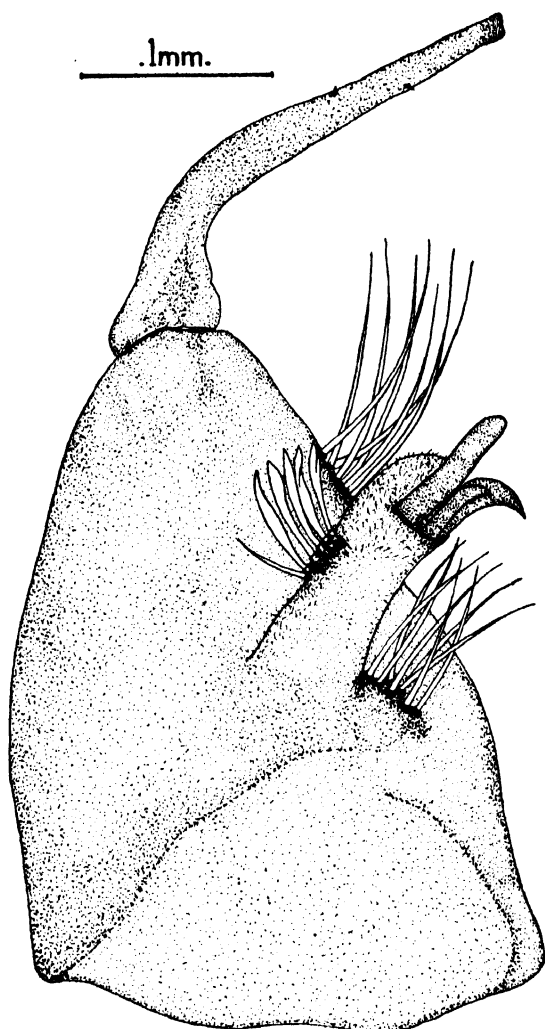
Culex salinarius Coq.

Fig. 19. Sidepiece.

Fig. 20. Mesosoma: plate (lateral view; inner side); D=dorsal arm; TH=tooth;
V=ventral arm.

Fig. 21. Tenth sternite (TS) and mesosoma plate (M). (dorsal view).

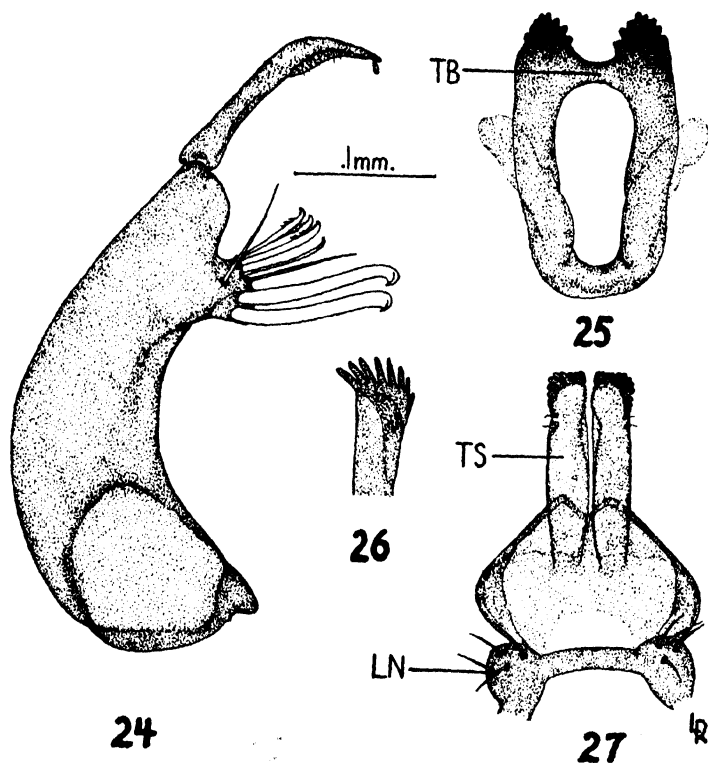
Fig. 22. Ninth tergite.



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Culex bahamensis D. and K.

Fig. 23. Sidepiece.



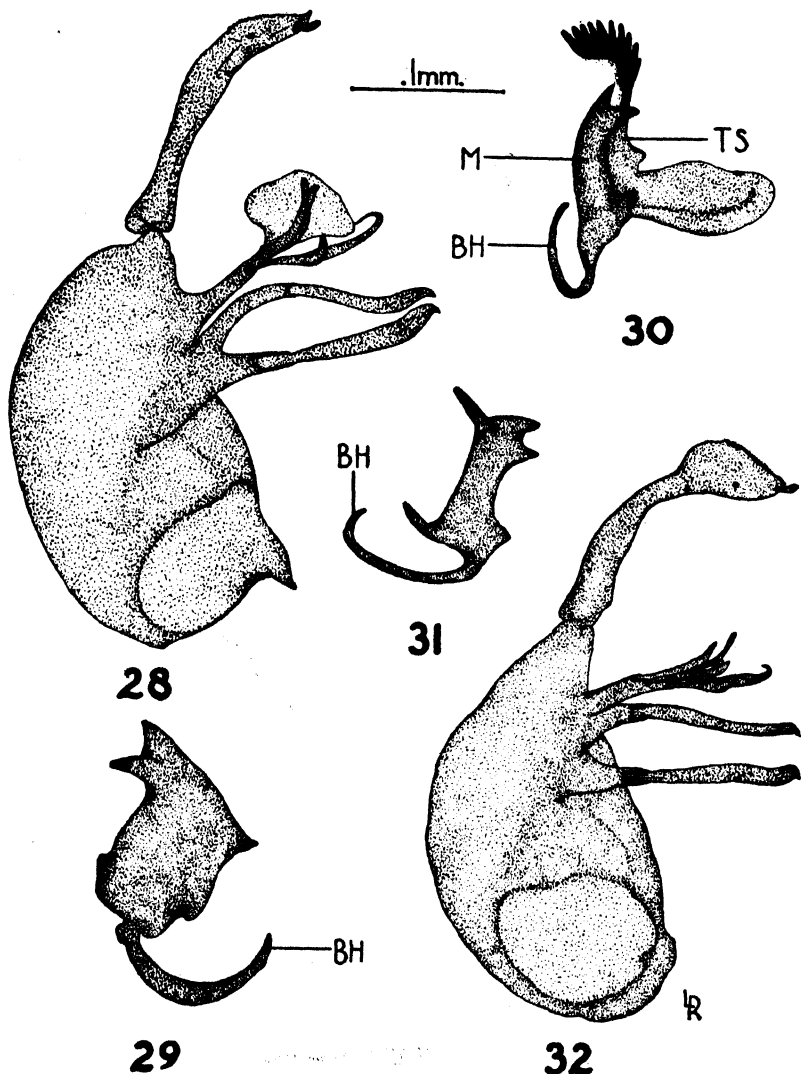
Culex apicalis Adams

Fig. 24. Sidepiece.

Fig. 25. Mésosome. TB=transverse bridge.

Fig. 26. Apical half of the tenth sternite. (dorsal view; flattened).

Fig. 27. Tenth sternites (TS) and ninth tergite. LN=lobe of ninth tergite.



Culex erraticus D. and K. and *Culex pilosus* (D. and K)

Fig. 28. Sidepiece of *C. erraticus*.

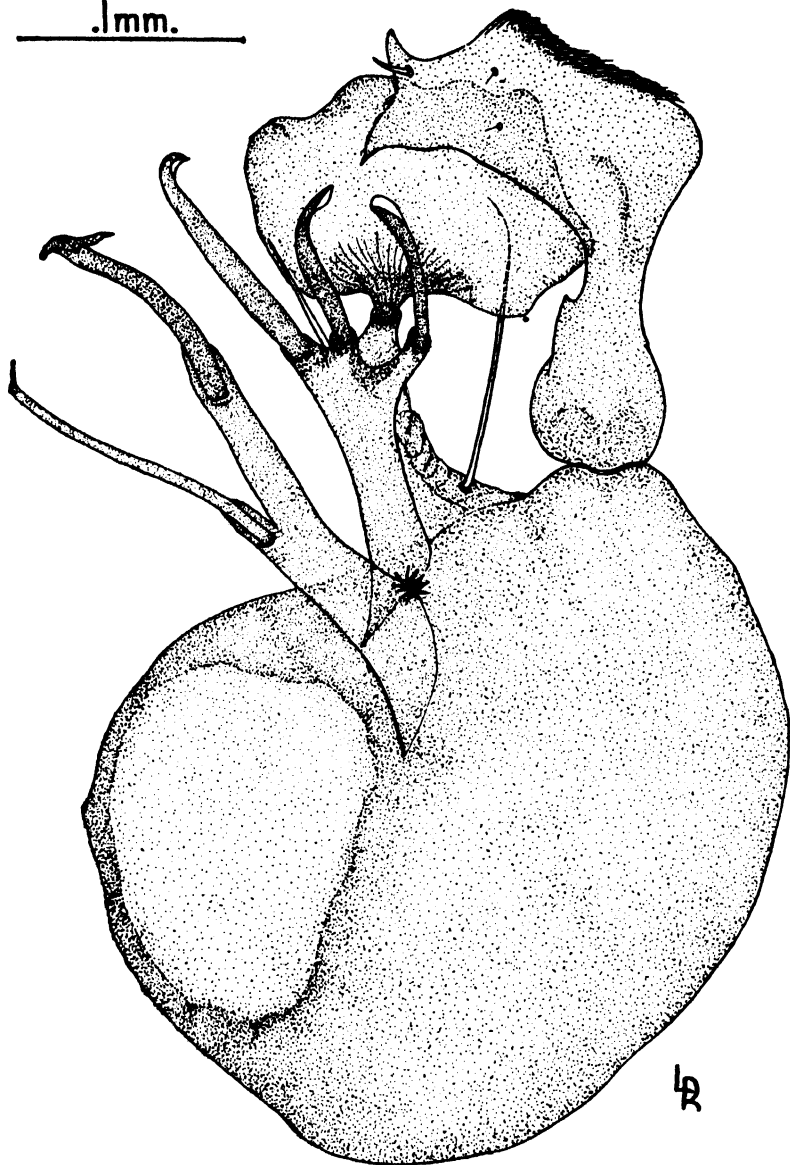
Fig. 29. Mesosomal plate of *C. erraticus*. (lateral view); BH=basal hook.

Fig. 30. Tenth sternite (TS) and mesosomal plate (M) of *C. erraticus*. BH=basal hook. (dorsal view).

Fig. 31. Mesosomal plate of *C. pilosus*. lateral view). BH=basal hook.

Fig. 32. Sidepiece of *C. pilosus*

.1mm.



33

Fig. 33. Sidepiece.

Culex peccator D. and K.

(133)

A NEW SUBFAMILY OF STAPHYLINIDAE, THE PULICOMORPHINAE (COLEOPTERA)

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The staphylinid tribe Pulicomorphini is raised to the rank of subfamily, pulicomorphinae, and includes two genera of small beetles. *Pulicomorpha* Mann and *Beyeria* Fenyès. The species in these genera are of peculiar form resembling ants, or fleas, or wingless Proctotrupoidea, especially species of the genus *Lagnynodes*. One species is known to occur with ants.

The genus *Beyeria* was proposed for *B. vespa* Fenyès (1910) collected in the Rincon Mountains in Arizona. Fenyès assigned this genus to the subfamily Aleocharinae without considering the conical shape of the hind coxa. He also believed *vespa* to have a 5-5-5 tarsal formula and placed *Beyeria* in the tribe Aleocharini. Later (1921) he segregated a group of Aleocharini, possessing 4-segmented maxillary palpi, under the new tribe Oxypodini, and included *Beyeria*. However, the hind coxae of *Beyeria* are not transverse and flattened, as in the Aleocharinae, and examination of a male and female *vespa* from the original series proves the front tarsus to be 4-segmented.

Pulicomorpha was proposed for *P. coecum* Mann (1924), a species of blind staphylinid collected by Wm. Mann in a colony of ants at La Palma Davila in Lower California. This genus was placed in a new tribe, Pulicomorphini, in the Aleocharinae without any discussion of its conical hind coxae. Mann placed it near the tribe Thamiaracini on the statement that the labial palpus was 2-segmented. However, Mann did not consider the palpiger as a true segment of the palpus, so that as conventionally used in coleopterous descriptions, the palpus is 3-segmented. This removes it from a position near the Thamiaracini. *Pulicomorpha* was compared with *Beyeria* by Mann, and among other differences, he mentioned that they were unlike in tarsal segmentation and the number of segments of the labial palpus. These characters are actually the same in the two genera, and they possess additional features that associate them closely and remove them from any known subfamily of Staphylinidae.

The subfamilies of Staphylinidae have been distinguished chiefly on the basis of coxal characters and the position of the antennal bases. The posterior coxae may be conical, triangular, transverse, or globose, and the antennae may be inserted at the sides of the front, at front margin of the front, or between the eyes. The Pulicomorphinae differs from the Aleocharinae chiefly on the basis of the conical instead of transverse posterior coxae. It does, however,

have the 4-5-5 tarsal formula in common with the aleocharine tribe Myrmedoniini, a character heretofore recorded for no other group of Staphylinidae outside the Aleocharinae. The Pulicomorphinae also have the antennae situated between the eyes as in the Aleocharinae. From the Paederinae, the Pulicomorphinae differs chiefly in the 4-5-5 formula, and the insertion of the antennae between the eyes. The Paederinae usually have the tarsi 5-segmented, and the antennae are inserted on the sides of the front. Both Paederinae and Pulicomorphinae have the posterior coxae conical.

In addition to the characters indicated to distinguish the Pulicomorphinae from its close allies, the Aleocharinae and Paederinae, the following combination of characters will aid in distinguishing it from other subfamilies.

Pulicomorphinae new subfamily

Body, with exception of abdomen, laterally compressed. Abdomen somewhat depressed with basal segments narrowed and constricted to form a "gaster-like" structure; remainder of abdomen suddenly swollen and much wider than contiguous elytra. Species dimorphic. All coxae conical, and generally long and prominent; posterior coxae contiguous at base, middle coxae contiguous or separated, anterior coxae cavities separated but coxae may be contiguous near apices. Antenna 11-segmented, inserted on front close to eye and just behind front margin of eye. Legs slender, posterior leg equal in length to entire body. Tarsal formula 4-5-5. Maxillary palpi 4-segmented, labial palpi 3-segmented. Mandibles simple or with very slight swelling on inner margins. Genae and sides of pronotum unmargined.

So far as known, the only genera that constitute this new subfamily are *Pulicomorpha* and *Beyeria*. They possess all of the subfamily characters in common but differ from each other in several important respects.

Key to Genera of Pulicomorphinae

Eyes absent; middle coxae contiguous; intermediate antennal segments transverse; gaster horizontal *Pulicomorpha*
 Eyes present; middle coxae separated; intermediate antennal segments quadrate; gaster apparently can be elevated to vertical position *Beyeria*

Pulicomorpha Mann

The genotype and only species in the genus, *Pulicomorpha coecum* Mann, was described from a series of males and females collected at La Palma Davila, Lower California, in a colony of *Eciton peninsu-*

laris Mann beneath a stone near a water hole. The length given for the female was 1.5 to 1.75 mm., and for the male, 1-1.25 mm. According to Mann, *Pulicomorpha* added a new category to resemblance to inquillinous insects in that it was dimorphic, "the stouter bodied, larger sized female with its short and thick head, and the more slender, smaller male, with long head, corresponding to the major and minor workers of *Eciton californicum*." In addition to the absence of eyes, *P. coecum* is further described as having the coxae contiguous, intermediate antennal segments transverse and gaster horizontal. Presumably the hind wings are absent.

Beyeria Fenyes

Beyeria vespa Fenyes has remained, until now, the only species in the genus *Beyeria*. The discovery of a second species, from the Ozark Mountain region in Arkansas, necessitates a redescription of the genus. In addition to the description of the new species, *vespa* is recharacterized, and illustrations are presented to aid in separating the two. I am indebted to Mr. Howard Notman for the privilege of studying a pair of *vespa* that he had from the original collection.

Body ant-like in form and straw yellow in color. Head longer than wide, with a deep and extensive depression between the eyes. Gena longer than eye and narrowed to neck. Antenna slightly elbowed at end of first segment, 11-segmented, about three and one-half times longer than width of head across eyes, inserted on front of head just behind anterior margin of eye; first segment a little more than twice as long as wide, second segment shorter and narrower than first, fourth to tenth segments as wide as third at apex and each nearly quadrate, eleventh segment longer than tenth. Labrum transverse, slightly emarginate in front. Mandibles simple and with at most a slight swelling on the inner margin. Maxillary palpus 4-segmented (Fig. 14); lacinia shorter than galea, inner margin clothed with dense fringe of setae which become coarser and tooth-like toward apex; galea with brush of setae covering only the apex; first segment of palpus nearly quadrate, second twice as long as first, apex more than twice as wide as its base, third segment as wide as second, two to three times longer than its width, fourth segment about four times longer than wide, one-third the width of third segment and about one and one-half times longer than the third segment is wide. Mentum transverse, widened posteriorly, emarginate in front, and with anterior angles prominent; labial palpus 3-segmented succeeding segments narrowed, first two segments about twice as long as wide, third about four times longer than wide and two-thirds width of second. Pronotum longer than wide, narrowed

toward front, equal in width to head, and about equal in length to head; sides evenly rounded and unmarginated, hind angles rounded; front coxal cavities open behind; spiracles concealed from the side and apparently attached to the end of the free lying and very lightly sclerotized epimeron; prosternum widely separating the coxal cavities, although coxae may be contiguous, and distinctly keeled. Mesosternum shorter than metasternum, meeting the metasternum between the middle coxae and rounded or truncate behind; middle coxae separated by a distance from one-half to the width of coxa. Hind coxae contiguous at base. Elytra wider than pronotum and slightly longer, evenly curved on disc then more sharply rounded to the nearly perpendicular sides; each elytron about twice as long as wide. Wings present. Legs very long and slender, the posterior ones equal in length to entire body. Tarsal formula 4-5-5. Abdomen constricted at base and suddenly enlarged near middle of third segment or gradually enlarged from base; enlarged part of abdomen slightly longer than wide, margined, slightly convex on the dorsum and strongly curved on venter; eighth sternite apparently sexually unmodified. Antennae, tarsi, and tibiae more densely clothed with yellowish setae than remainder of body.

The abdomen is "hinged" between the second and third segments and in life the beetle can probably elevate it to a vertical position. Considering the peculiar form in this genus, it is not improbable that the species may live in ant nests.

Genotype: *Beyeria vespa* Fenyès.

Beyeria pulex new species

The abbreviated groove on the head, shorter third antennal segment, rounded anterior pronotal angles, ungrooved pronotum, and more sharply pointed prosternum will readily separate this species from *vespa* Fenyès. In *pulex* the third abdominal segment is similar in both sexes.

Male:—Length, with head deflexed, 2.5 mm. Color almost uniformly straw-yellow, eyes and apices of mandibles only darker. Head, from front margin of clypeus to constriction of neck, one-fifth longer than width across eyes. Frontal groove ending on vertex a little beyond a line through hind margins of eyes. Side of head behind eye about one and one-half times length of eye, nearly parallel for half the length and gradually rounded to constriction. Neck swollen, slightly transverse, and width equal to one-half width of head behind eyes. Third antennal segment (Fig 10) subequal in length to second segment, eleventh about one-third longer than tenth. Third

segment of maxillary palpus (Fig. 7) one third longer than second or fourth segments. Mentum (Fig. 3) deeply and broadly emarginate anteriorly, emargination equal to one-fourth length of mentum; sides nearly parallel in apical third then strongly expanded and rounded to the nearly truncate base. Gular sutures converging at middle of head. Pronotum nearly one and one-half times longer than wide; sides slightly convergent in basal three-fifths then almost sharply narrowed and straight to apex which is one-half greatest width of pronotum; front margin slightly rounded; front angles of pronotum, seen from side, evenly rounded. Prosternum strongly and entirely keeled and pointed behind. Elytral emargination at apex about one-sixth of length of elytra from line through apices to apex of scutellum. Pronotum and elytra provided with shallow setae bearing punctures, punctures separated from once to twice their diameters. Mesosternal process flattened, broadly joining metasternum, subtruncate behind, and equal in width to diameter of middle coxa. Second abdominal tergite a little longer than wide, constricted near base, then suddenly and broadly elevated and rounded in posterior half. Third tergite with an evenly rounded and recurved process that extends beyond posterior margin of second tergite. Second abdominal sternite (Fig. 1) firmly joined to third sternite, as long as greatest width of hind trochanter and regularly rounded. Third abdominal sternite (Fig. 1), viewed from lateral aspect, four times broader at posterior margin than at base where it is narrowed and has a forward pointing dorsal projection joined to second sternite. Abdomen smooth and shining, about one and one-third times width of body across elytra, and sharply pointed behind. Trochanter of hind leg about twice as long as wide. Ratio of tarsal segments beginning with basal segment—anterior, 3-4-4-8, middle, 6.5-6.5-6.5-5.5-9; posterior, 15-11-10-8-11.

Genitalia as in figure 13. Aedeagus three times longer than wide, broadest and rounded at base with sides near base a little angulate; sides behind angles nearly parallel then convergent and nearly straight sided to rounded apex in apical one-sixth.

Female—Length, color, and external structure same as for male, and separated from that sex by its broader abdomen which is nearly twice as wide as width of body across elytra. Bursa copulatrix as in figure 8 consisting of a bulbous swelling at either end of a narrow, recurved and nearly parallel sided tube.

Holotype, male:—Fayetteville, Arkansas: May 22, 1941, at liggt. Milton W. Sanderson.

Allotype, female:—same data as for holotype.

Paratypes:—Arkansas:—Fayetteville: July 24, 1940 1♂; 1941—April 30, 1♂; May 22, 1♀; May 23, 1♀; May 24, 1♀; May 25, 2♂; May 28, 1♀; May 30, 3♀; May 31, 1♂; June 6, 2♂; July 4, 1♂; July 26, 1♀; July 28 1♀; July 29, 1♀; October 24, 1♀. 1942—May 10, 1♀; May 13, 1♀; May 21, 1♀; May 31, 1♂; June 1, 1♀; June 5, 2♂; June 9, 1♀; June 10, 1♂; June 11, 1♂; June 17, 1♀; June 27, 1♀; July 3, 1♀; July 14, 1♀. All paratypes collected at light. Milton W. Sanderson.

The holotype, allotype, and paratypes are deposited in the collection of the Illinois Natural History Survey. Additional paratypes are deposited in the collections of the University of Kansas, United States National Museum, Howard Notman, C. A. Frost and C. H. Seevers.

***Beyeria vespa* Fenyès**

The entire frontal groove, longer third antennal segment, distinct anterior pronotal angles, grooved pronotum, and less strongly produced posterior prosternal margin will distinguish this species from *pulex* Sanderson. The third abdominal segment is more bulbous in the female than in the male. This species is also a little larger than *pulex*.

Male:—Length, with head deflexed, 3.2 to 3.5 mm. Color, dark straw yellow, eyes and apices of mandibles darker. Head, from front margin of clypeus to constriction of neck, one-fifth longer than width across eyes. Frontal groove extending full length of head although shallow and narrowed posteriorly. Side of head behind eye one and one-half times length of eye, and triangularly convergent to constriction. Neck scarcely swollen, transverse, width equal to one-half width of head behind eyes. Third antennal segment (Fig. 11) nearly one and one-half times longer than second; eleventh twice as long as tenth. Third segment of maxillary palpus (Fig. 6) twice as long as second or fourth segments. Mentum (Fig. 5) shallowly emarginate anteriorly; sides rather suddenly constricted at apical one-eighth behind prominent front angles, then enlarged and rounded to distinct angles in basal one-third; base of mentum rounded from angles and somewhat flattened on lower margin; a large depression on either side of middle and in posterior half equal to about one-fourth greatest width of mentum. Gular sutures diverging at middle of head. Pronotum one and one-third times longer than wide; sides parallel in basal two-thirds then slightly convergent and parallel to apex; apex two-thirds greatest width of pro-

notum; anterior margin distinctly rounded in middle three-fourths; posterior margin evenly curved from rounded angles; anterior angles of pronotum, seen from side, nearly right angled; pronotum with a deep groove laterally on the side equal to about one-third pronotal length. Prosternum keeled between front coxae and slightly pointed behind. Elytral emargination at apex very shallow and about one-eighteenth length of elytra from line through apices to apex of scutellum. Pronotum and elytra provided with shallow saetae bearing punctures, the punctures much more distinct on elytra and separated from once to several times their diameters. Mesosternal process flattened, slightly rounded posteriorly where it joins the rounded anterior margin of metasternum; intercoxal space equal to about one-half width of middle coxa. Second abdominal tergite slightly more than one and one-half times longer than wide, nearly parallel in basal half then widened and nearly parallel in apical one-half; disc slightly convex and not elevated posteriorly; a distinct sinuation at each posterior angle; posterior margin nearly truncate. Third tergite with base recurved and evenly rounded. Second abdominal sternite (Fig. 4) firmly joined to third; second sternite one-third width of hind trochanter and transversely carinate near third sternite. Third sternite (Fig. 4) viewed from lateral aspect, twice as broad at posterior constriction as at narrowed base just behind the small, quadrate, vertical projection. Abdomen smooth and shining and sparsely provided with suberect to erect yellow setae varying in length. Trochanter of posterior leg one and one-half times longer than wide. Ratio of tarsal segments beginning with basal segment—anterior, 5.5-3.5-8; middle, 8-6-5-4-9; posterior, 14-9-7-5-10.

Genitalia as in figure 12. Aedeagus two and one-third times longer than greatest width, nearly circularly rounded in basal half then narrowly prolonged into a process about one-third to one-fourth as wide as basal swelling, and slightly narrowed to rounded point.

Female:—Length, color, and most external features same as for male except as follows: third sternite (Fig. 2) viewed from lateral aspect, one and one-half times broader before posterior constriction than at base; vertical projection twice as long as high. Bursa copulatrix as in figure 9. Tube contorted at either end, nearly parallel sided and with one end formed into an enlarged apically narrowed, and U-shaped hook; side angulate below hook.

Four specimens of this species were collected in the Rincon Mountains in Arizona, 5000 feet above sea level, July 1907, Gustav Beyer. According to Fenyés, apparently quoting Beyer, "the beetles came to the camp-light with a number of wasps of the same size and

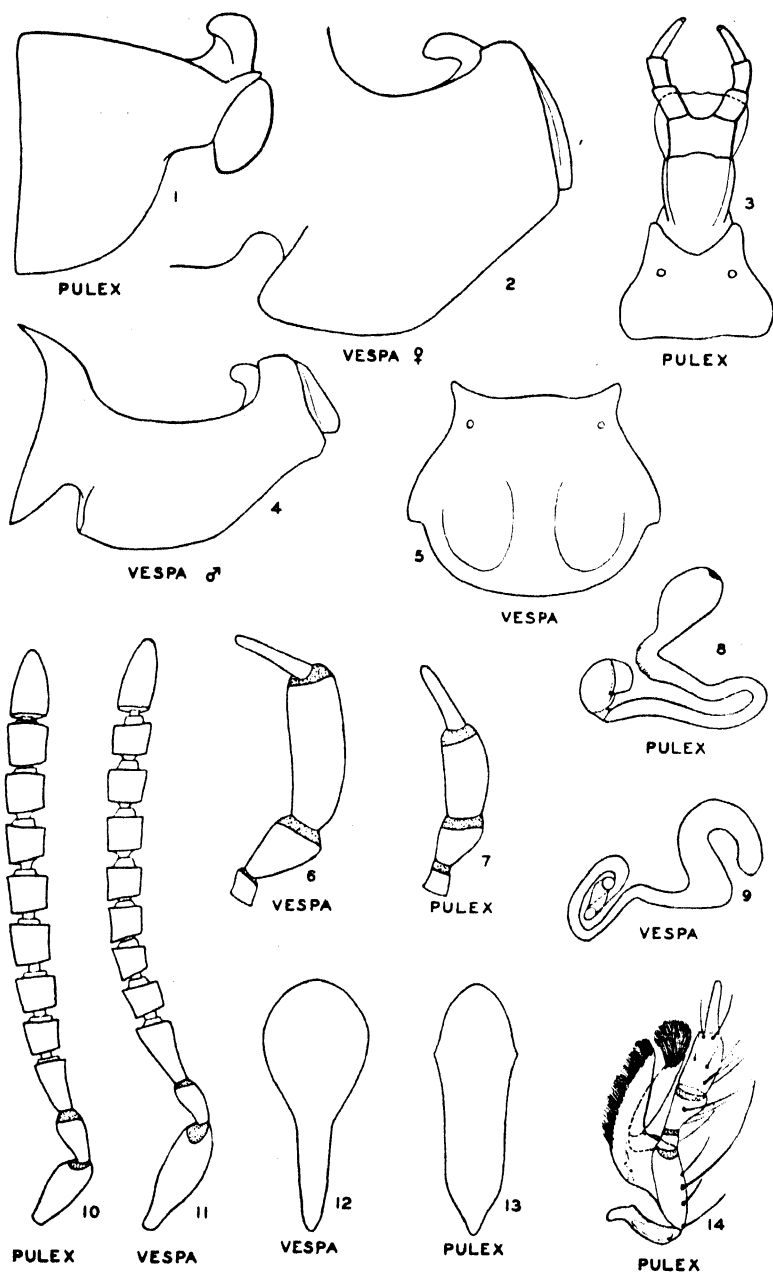
color, the two insects being scarcely distinguishable when on wing." Type and a second specimen in the collection of the California Academy of Sciences. The two remaining specimens of the original series are a male and female in the collection of Howard Notman, Long Island, New York.

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EXPLANATION OF PLATE.

- Fig. 1. *Beyeria pulex* n. sp. Lateral view of second and third abdominal sternites of female.
- Fig. 2. *Beyeria vespa* Fenyés. Lateral view of second and third abdominal sternites of female.
- Fig. 3. *Beyeria pulex* n. sp. Labium of female.
- Fig. 4. *Beyeria vespa* Fenyés. Lateral view of second and third abdominal sternites of male.
- Fig. 5. *Beyeria vespa* Fenyés. Mentum of female.
- Fig. 6. *Beyeria vespa* Fenyés. Right maxillary palpus of female.
- Fig. 7. *Beyeria pulex* n. sp. Right maxillary palpus of female.
- Fig. 8. *Beyeria pulex* n. sp. Bursa copulatrix.
- Fig. 9. *Beyeria vespa* Fenyés. Bursa copulatrix.
- Fig. 10. *Beyeria pulex* n. sp. Left antenna of female.
- Fig. 11. *Beyeria vespa* Fenyés. Left antenna of female.
- Fig. 12. *Beyeria vespa* Fenyés. Aedeagus.
- Fig. 13. *Beyeria pulex* n. sp. Aedeagus.
- Fig. 14. *Beyeria pulex* n. sp. Right maxilla of female.



SEASONAL ABUNDANCE AND DISTRIBUTION OF LARVAE OF THE CLEAR LAKE GNAT

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The economic importance of the Clear Lake gnat, *Chaoborus astictopus* D. and S., near the shores of Clear Lake was recorded by Herms (1937). Adult habits and emergence from the lake were reported by Lindquist and Deonier (1942). This paper gives information on the distribution, abundance, and seasonal habits of the larvae, which has been obtained from a study of thousands of mud samples taken from the bottom of Clear Lake, Lake County, Calif. over a period of 3 years.

Fifteen collecting stations approximately three-fourths mile apart were established from shore to shore on the upper arm of the lake, nine stations on a line running north and south, line A, and six stations on a line running east and west, line B (Fig. 1). At each station three mud samples were taken twice a month throughout the year. Samples were also taken at numerous places on the southern end of the lake.

Methods:—A standard 6-inch Ekman dredge was used in taking the bottom samples. The mud samples were sieved through a 50-mesh screen, which allowed the mud to pass through but retained all except the smallest larvae. The larvae were then washed into pint jars and taken to the laboratory for counting.

Bottom water temperatures were recorded when samples were taken. Likewise, the turbidity of the water was tested with a white disk, 10 cm. in diameter, known as a Secchi disk.

Temperature and Turbidity of Water in Clear Lake:—The bottom of the northern arm of Clear Lake is saucer-shaped, with the greatest depth about 30 feet. There is no thermocline, and the water is comparatively warm during winter (Table 1). The temperature of the water is uniform over the greater part of the lake. The area within one-fourth mile of the shore, however, may be 1 to 3 degrees warmer or colder than the middle, depending on air temperature and storms.

There was very little difference in turbidity between the stations, but occasionally the water would be clearer in the middle of the lake.

Table 1:—Average bottom-water temperatures and relative turbidity of water at stations in line A throughout the 3-year period.

Date	Temperature, °F			Relative Turbidity as indicated by Inches in Water at which Secchi Disk Could Be Seen.		
	1939	1940	1941	1939	1940	1941
Jan. 10	48.1	50.0	48.0	14.2	14.0	10.8
Jan. 25	47.6	49.1	49.1	16.4	18.2	10.9
Feb. 10	45.3	51.4	49.2	15.7	18.7	7.9
Feb. 25	48.7	50.0	51.8	20.6	14.2	9.6
Mar. 10	50.4	53.0	51.5	17.3	5.7	7.9
Mar. 25	52.0	55.5	53.8	27.2	17.2	11.8
Apr. 10	57.4	56.3	55.3	14.1	15.9	12.3
Apr. 25	59.4	60.8	56.3	15.4	21.6	27.3
May 10	62.2	62.3	61.7	18.2	16.9	27.7
May 25	65.2	68.3	65.2	16.0	41.7	34.3
June 10	68.6	69.1	67.0	14.4	26.7	32.7
June 25	70.1	72.0	68.3	19.2	72.1	14.1
July 10	74.3	78.0	69.4	26.9	30.2	54.2
July 25	76.2	77.7	79.0	27.7	48.9	71.0
Aug. 10	78.1	77.7	77.2	21.0	37.8	75.8
Aug. 25	74.2	76.6	72.9	12.6	22.6	20.7
Sep. 10	71.1	71.6	71.3	11.7	14.0	28.0
Sep. 25	70.3	69.0	66.0	18.7	15.0	21.7
Oct. 10	64.1	65.3	64.7	21.8	21.6	15.4
Oct. 25	64.3	65.4	58.7	22.1	24.6	9.6
Nov. 10	59.9	57.9	58.8	19.6	18.3	10.7
Nov. 25	57.1	52.8		15.3	19.8	
Dec. 10	53.8	52.0		16.5	20.9	
Dec. 25	52.2	50.0		18.2	12.4	

The two southern arms were always clearer than the northern end. During January through March in 1940 and 1941 the water was very turbid (Table 1), owing to the heavy load of silt carried by flood waters. Within certain limits the water was clearest from May through July. Compared with many mountain lakes, Clear Lake is fairly turbid the greater part of the time. No correlation has been found between water turbidity and distribution of larvae.

Distribution of Larvae:—Except in shallow water a few hundred feet offshore, larvae were found in numbers at every place where samples were taken. In the southern arms of the lake, where the water was deep, larvae were taken in abundance as near as 100 feet

offshore. No great difference in larval abundance was found between the northern and southern extremities. Although many miles apart, similar depths showed similar numbers of larvae.

Eggleton (1931) refers to seasonal concentration zones or distribution of bottom organisms according to depth of water in Third Sister Lake, Mich. A definite correlation between the water depth and number of *Chaoborus* larvae was found to exist during the greater part of the year in Clear Lake. As an example, from January to March 1941, in 12 to 15 feet of water 32 larvae per sample were taken, in 15 to 20 feet 103 larvae, in 20 to 25 feet 148 larvae, in 25 to 30 feet 185 larvae, and in 30 to 33 feet 242 larvae. At times during the summer the bottom samples in shallow water near shore showed heavy concentrations of immature larvae which had not yet been distributed to greater depths.

A shoreward movement of the overwintering larvae was indicated during the spring, and for a short time the largest populations of mature larvae were taken at stations 500 to 2,000 feet offshore. In May 1939 the station nearest shore at each end of lines A and B averaged 75 larvae per sample, whereas the stations in deeper water averaged 145 larvae. On June 7 it was indicated that the shoreward movement of larvae was beginning, because the two stations nearest the shore at each end of the lines averaged 95 larvae whereas the remaining 7 stations in deeper water averaged only 73 larvae. On June 21 it was evident that the greatest larval population existed near shore because these stations averaged 31 larvae and those in the lake averaged 21. In July and August and throughout the winter the mature larvae were always found in greatest abundance in the deeper parts of the lake. A similar shoreward movement of overwintering larvae was recorded in June 1941.

Bottom samples did not indicate that the pupal population was greatest near shore. Emergence, however, was invariably greater at that point (Lindquist and Deonier 1942). The data strongly showed that some sort of larval shifting, or migration, occurred. The reasons for the shoreward movement are not clear.

Concentration of Larvae in Mud:—There was some question as to whether the Ekman dredge penetrated sufficiently deep into the mud to capture all larvae. A specially constructed sampler which could be pushed deep into the bottom, however, showed the heaviest concentration of larvae in the upper 4 inches.

There appeared to be some seasonal differences, but throughout most of the year 84 to 93 per cent of the larvae were in the upper 4 inches. A few larvae were taken 4 to 8 inches below the surface

of the lake floor and a very small percentage 8 to 12 inches. During October through December 1939, 61 per cent of the larvae were taken in the upper 4 inches. It is not known whether the distribution of larvae varies in different types of mud or in different water depths. Since the Ekman dredge penetrated the mud about 5 inches, it is believed that approximately 90 to 95 per cent of the larvae were recovered by the method employed.

Seasonal Abundance:—The average number of larvae and pupae per sample taken on lines A and B twice monthly from April 25, the approximate beginning of adult emergence, to October 25, when the overwintering population reached its peak, is shown in Table 2.

Table 2:—Seasonal abundance of the Clear Lake gnat.

Average Number of Larvae or Pupae per Sample.			
Date	1939	1940	1941
Apr. 25	189	99	109
May 10	155	92	101
May 25	126	81	61
June 10	85	60	47
June 25	24	168	33
July 10	45	233	26
July 25	53	215	206
Aug. 10	89	189	209
Aug. 25	50	199	105
Sep. 10	59	179	79
Sep. 25	80	134	78
Oct. 10	105	150	81
Oct. 25	251		
Oct. 25	138	187	110
'1938	,		

From these data it is evident that great differences in population exist from month to month and from year to year. Weather conditions, more than any other single factor, no doubt account for this variation. The spring and summer reduction of larvae is due mainly to the emergence of adults, which is followed by oviposition and a new crop of larvae. The critical period is from 6 to 10 p. m. daily, when strong winds or temperatures below 55° F. reduce or prevent oviposition. In 1940 a heavy oviposition, due to abnormally warm and calm weather, caused a low spring population to increase to a peak of 233 larvae on July 10, and in 1941 a heavy oviposition during a few days of favorable weather from June 27 to July 2 brought about an increase from 26 larvae per sample on July 10 to 206 on July 25.

Of practical significance is the length of time the overwintering larvae continue to pupate and emerge. At least 67 days in 1939 and 76 days in 1941 were required for the overwintering larvae to emerge, notwithstanding the fact that all of them were in the last instar in April. The length of time required for summer broods to complete development can not ordinarily be computed because of the intermingling of generations. In 1941 weather conditions restricted oviposition largely to the period June 27-July 2. The majority of these larvae emerged between August 10 and 25 after a development period of 6 to 7 weeks. Development in the laboratory can be very rapid (Deonier 1942).

The larval populations during the first part of April showed decreases of 24.7, 28.2, and 41.7 per cent from those found the preceding October. These reductions are due to feeding on the larvae by the various species of fish and to other, unknown causes.

The difference in population between the beginning of the active season and the fall varied, a 27.0 per cent decrease occurring in 1939, an 88.8 per cent increase in 1940, and no change in 1941. It is evident that the insect was not able to increase beyond certain limits during the summer. For instance, the large population in July 1940 did not increase, and in fact could not maintain the same level, even when the weather appeared favorable for oviposition.

The number of larvae taken per sample at each of the stations on selected dates during 1941 is recorded in Table 3. Variations at a station were frequent during the winter, but on the whole the number of larvae recovered on a line was consistent. Because of water currents some shifting of larval population is to be expected. The average number of larvae taken per sample for the period January-March 1941 is given in figure 1.

It is difficult to estimate the total number of larvae in the lake at any one time, but during the fall of 1938 a population of 800 billion was considered a reasonable approximation.

Summary:—According to bottom samples taken with an Ekman dredge in Clear Lake, Lake County, Calif., larvae of the Clear Lake gnat were found well distributed in the lake except in shallow water near shore. A gradual increase of larvae was found from shallow to deep water during the year except for a short period in the spring, when mature overwintering larvae concentrated near shore, and in the summer, when immature larvae occasionally became abundant near shore.

Table 3:—Larval abundance at the various stations in 1941:

Number of Larvae per Sample

Line A:

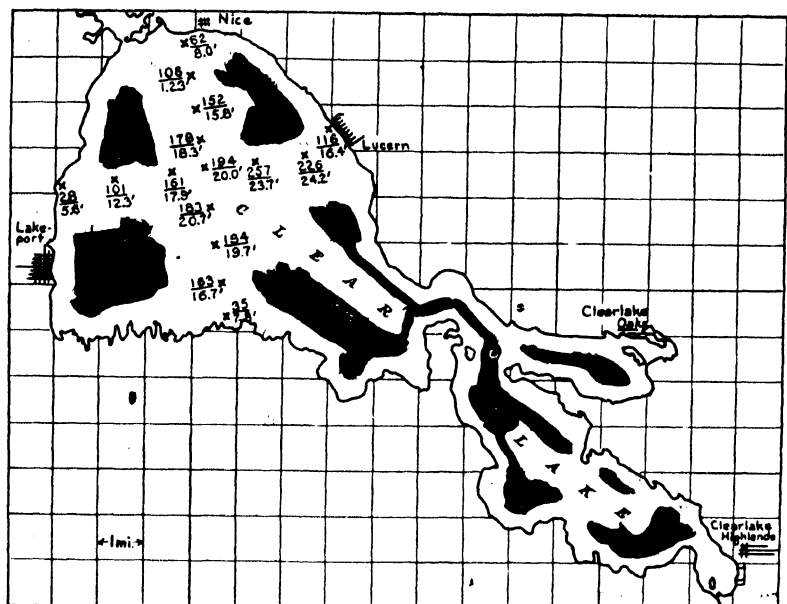
Station	Apr. 8 (Overwintering Population)	July 7 (Spring Minimum)	Aug. 11 (Summer Peak)	Oct. 7 (Fall Min- imum)	Oct. 29 (Fall Peak)
1.	45	14	179	53	40
2.	49	13	144	100	55
3.	70	33	317	95	151
4.	169	21	207	88	156
5.	183	19	271	95	163
6.	160	14	223	45	157
7.	167	17	290	61	145
8.	175	23	99	112	107
9.	32	49	92	28	68

Line B:

	56	58	164	115	63
2.	176	36	356	130	168
3.	186	18	320	104	191
4.	132	33	234	80	115
5.	61	24	166	68	52
6.	17	22	72	47	16

From 84 to 93 per cent of the larvae were found in the upper 4 inches of bottom mud most of the year and a small percentage penetrated as deep as 12 inches.

Great seasonal differences in population existed, ranging from an average of 251 larvae per 6 square inches in October to 24 in June. Yearly differences were also evident. The overwintering population showed a decrease of 24.7 per cent in 1939, 28.2 per cent in 1940, and 41.7 per cent in 1941.



NOTE:—The figures 1.23 near the top of plate should be 12.3.

Fig. 1:—Average number of *Chaoborus* larvae per sample taken at collecting stations on lines A and B, January through March 1941, together with water depths at zero (low water level), Rumsey gauge readings.

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ADDITIONS TO THE SOUTH DAKOTA LIST OF HEMIPTERA

HALBERT M. HARRIS

In a previous study 224 species of Hemiptera, exclusive of the Miridae and Corixidae were recorded from South Dakota¹. The present report adds 30 additional species, indicated in the list below with the asterisk, and gives collection data on certain species which were tabulated without such in the other paper. As before, I am indebted to Professor Harry C. Severin whose diligent collecting and friendly interest have made the studies possible.

Family SCUTELLERIDAE

Euptychodera corrugata V. D.* Belle Fourche, July 6, 1941, N. P. Larson.

Family THYREOCORIDAE

Galgupha ovalis Hussey. * Englewood, June 18, 1925, H. C. S.

Galgupha lobostethia Sailor. * Whitewood, June 8, 1923, G. I. Gilbertson.

Cydnoides albidipennis (Say). * Yankton, Sept. 27, 1923, H. C. Severin.

Family PENTATOMIDAE

Brochymena arborea (Say). * Yankton, Sept. 27, 1923, H. C. Severin.

Mecidea longula Stal. * Capa, Aug. 15, 1922, H. C. S.

This form is larger than specimens from Texas, and its third antennal segment is noticeably longer than the fourth.

Thyanta acerra McAtee. * Sandhills, Martin, Sept. 3, 1923, H. C. S.

Thyanta punctiventris Van Duzee. * Chamberlain, July 24, 1940, under lights, H. C. S.

Acrosternum hilare (Say). Canton, Aug. 28, 1923, H. C. S.

Apateticus bracteatus (Fitch). Lake Hendricks, Aug. 17, 1923, H.C.S.

Perillus circumcinctus Stal. * Buffalo, Aug. 29, 1924, H. C. S.

Family COREIDAE

Mozena obesa Montandon. * Chamberlain, Aug. 31, 1923, H. C. S.

Family CORISCIDAE

Coriscus tomentosus (Fracker). * Newell, Aug. 31, 1922, H. C. S.

Tollius quadratus Van Duzee. * Custer Peak, July 29, 1939, N. F. Larson.

Family RHOPALIDAE

Arhyssus scutatus (Stal). Lead, Aug. 2, 1935. This is the species previously listed as *Corizus* sp.

Arhyssus indentatus (Hambleton). * Piedmont, May 1, 1941, H. C. S.; Belle Fourche, July 6, 1941, N. P. L.

¹Iowa State College of Science, XI:169-176. 1937.

Family ARADIDAE

Aneurus inconstans Uhler. * Fairfax, June 22, 1924, H. C. S.

Family NEIDIDAE

Jalysus wickhami Van Duzee. * Black Hills, June 28, 1937, H. M. H.

Family LYGAEIDAE

Blissus leucopterus (Say). Fairfax, Aug. 8, 1924, H. C. H.

Perigenes similis Barber. * Brookings, July 12, 1942, H. C. S.

Zeridoneus costalis (V. D.). Whitewood, Aug. 29, 1927, H. C. S.

Pseudocnemodius canadensis (Prov.). Hoesprings, Aug. 27, 1922, H. C. S.

Peritrechus saskatchewanensis Barber. * Chester, July 26, 1930; Chamberlain, July 24, 1940, H. C. S.

Drymus crassus Van Duzee. * Whitewood, Sept. 9, 1923, H. C. S.

Eremocoris ferus Say. * Yankton, June 20, 1924, H. C. S.

Scolopostethus thompsoni Reuter. * L. Hendricks, July 23, 1922, H. C. S.

Uhleriola floralis (Uhler). Newell, Aug. 26, 1924, H. C. S.

Family PHYMATIDAE

Phymata vicina Handlirsch. * Black Hills, June 28, 1937, H. M. Harris.

Family REDUVIIDAE

Oncocephalus nubilus Van Duzee. * Chamberlain, June 18, 1940, G. B. S.

Zelus exsanguis Stal. * Rapid City, July 24, 1923, H. C. S.; Brookings, Sept. 18, 1923, H. C. S.

Family NABIDAE

Nabis sordidus Reuter. * Yankton, June 20, 1924, H. C. S.

Nabis annulatus Reuter. * Bigstone, Aug. 20, 1924, H. C. S.

Nabis propinquus Reuter. * Waubay, Aug. 21, 1924, H. C. S.; Bigstone, Aug. 20, 1924, H. C. S.

Family ANTHOCORIDAE

Lytocoris campestris Fabr. * Vermillion, October 22, 1940, H. C. S.

Xylocoris sordidus Reuter. * Brookings, Aug. 20, 1942, H. C. S.

Family HYDROMETRIDAE

Hydrometra martini Kirkaldy. * Burke, June 11, 1940, H. C. S.; Elk Point, Aug. 20, 1940, G. B. S.

Family GERRIDAE

Gerris notabilis D. & H. * Black Hills, Rousseau Lake, June 22, 1940, H. C. S.

Gerris insperatus, D. & H. * Wood, July 23, 1939, H. C. S.; Smithwick, June 21, 1940, H. C. S.

Gerris comatus mickeli D. & H. * Larive Lake, June 22, 1940, H. C. S.

Family VELIIDAE

Microvelia buenoi Drake. * Brookings, May 11, 1939, H. C. S.

Rhagovelia rivale Torre-Bueno. * Rosebud, Little White River, Sept. 14, 1940, G. B. S.

Family SALDIDAE

Pentacora signoreti (Guerin). * Waubay Refuge, June 22, 1940, H.C.S..

Salda buenoi McDunnough. * L. Oakwood, June 14, 1923, H. C. S.;
Lake Andes, June 14, 1940, H. C. S.

Saldula confluenta Say. * L. Hendricks, July 12, 1922, H. C. S.;
Brookings, July 5, 1940, H. C. S.

Saldula severini, n. sp.

Closely related to *S. orbiculata* (Uhler) and strongly resembling that species in color and vestiture, but much smaller, more elongate-oval in shape, with the lateral edge of pronotum almost straight, not convexly arcuate as in *orbiculata*, and legs with shorter, less erect hairs.

Narrowly oval, deep black, the head, pronotum and scutellum shiny, hemelytra duller, with pale areas, the basal antennal segments and legs testaceous; upper surface thickly clothed with long, erect dark hairs, also fine, prostrate, pale, in part golden, pubescence. Head with front almost vertical, the brownish hairs projecting conspicuously; tylus pale; vertex with a pale point each side between ocellus and eye. Eyes large, reddish. Antennae with distal two segments brown, finely pubescent and also with scattered brown hairs, the basal segments pale, with dark clothing hairs; proportion of segments, (male) 7:13:9:10. Rostrum testaceous, extending between hind coxae. Pronotum transverse, the collar distinct, the transverse impression deep, the front lobe raised and foveate as in *orbiculatus*, the explanate lateral margins distinctly narrower than in *orbiculata*, the lateral edges almost straight. Scutellum perhaps a little flatter than in *orbiculata*, constricted as in that species. Hemelytron with six spots and the costal margin pale, the latter slightly shiny and gradually widened from the base, the spots situated as those in *orbiculata* but smaller, narrower and not so bluish. Membrane maculate with smoky brown. Legs with clothing hairs less numerous, shorter, and more reclined than in *orbiculata*, the length of those on tibiae being not noticeably greater than diameter of tibiae. Venter thickly, finely pubescent, black, the produced part of apical segment in female broadly pale.

Length: 3.1-3.6 mm. Width: pronotum, 1.2-1.3 mm.; hemelytra, 1.5-1.9 mm.

Holotype, male, Waubay, S. Dakota, June 22, 1939, H. C. Severin; allotype, female, Lost Island Lake, Palo Alto County, Iowa, September 16, 1932, H. M. Harris (in author's collection).

Named for Professor Harry C. Severin, whose assiduous collecting has contributed so much to the knowledge of South Dakota insects.

Family NOTONECTIDAE

Buenoa limnocastoris Hungerford. * Oak Lake, Sept. 17, 1941, H. C. S.; Elk Point, Sept. 5, 1940, G. B. S.

Buenoa macrotibialis Hungerford. * Oak Lake, Sept. 17, 1941, G. B. S.

Buenoa margaritacea Torre-Bueno. Canton, Aug. 26, 1923. H. C. S.

Family NEPIDAE

Ranatra fusca P. B. (= *americana* Mont.) Capa, June 1, 1921, H. C. S.; Belvidere, Sept. 22, 1939, G. B. S.

RACIAL VARIATION IN *STRYMON COLUMELLA* (FABRICIUS). (LEPIDOPTERA, LYCAENIDAE)

WILLIAM D. FIELD; Kansas.*

Comparisons made recently by the writer between Florida specimens of *Strymon columella* (Fabricius) and a series of specimens from Cuernavaca in the state of Morelos, Mexico, and from near Ciudad Victoria in the state of Tamaulipas, Mexico, taken by L. J. Lipovsky and H. D. Thomas in July and August of the year 1938, has led to the conclusion that two distinct subspecies are represented. According to Bates,¹ specimens from Cuba, Hispaniola, Jamaica, the Bahamas and Florida represent the same subspecies. This is of course the typical subspecies, described by Fabricius from the West Indies.² In the United States, typical *columella* extends from Florida through the Gulf States and has even been taken as far north as Aurora, New York, from which locality Grote³ described a specimen of *columella* as a new species under the name of *Callicista ocellifera*.

The name *Thecla istapa* Reakirt⁴ based upon specimens taken near Vera Cruz, Mexico, is available for the Mexican subspecies. *Strymon collumelle istapa* differs from *Strymon columella columella* in having all the maculation of the under surfaces greatly reduced. This is especially noticeable in the subanal eye spot found on this surface of the hind wing. In *istapa* the light colored lunule on the inner side of the marginal black spot is yellow, not orange as is the case in typical *columella*, and is rather thin being less than half as thick as the black spot. In *columella* the orange lunule is large, being as thick or nearly as thick as the black spot.

*Contribution from the Department of Entomology, University of Kansas. "Butterflies of Cuba". Bull. Mus. Comp. Zool. Harvard, vol. LXVIII, No. 2, p. 195, Feb. 1935.

¹Ent. Syst., 3, p. 282, 1793.

²Bull. Buff. Soc. Nat. Sci.; 1; p. 78, 1873

³Pr. Acad. Nat. Sci. 339, 1866.

A NEW U. S. RECORD (LEPIDOPTERA)

While collecting in the Big Bend country of Texas, near the town of Alpine, Dr. and Mrs. R. C. Turner, Jr., caught several specimens of a moth on April 28, 1942, which has been identified as *Hypopta* (*Comadia*) *redtenbacheri* Hamp. by T. N. Freeman of the Canadian National Museum. We have no record of this species having been recorded from the United States prior to this catch.—Don B. Stallings and Dr. J. R. Turner, Caldwell, Kansas.

AEDES AEGYPTI, LINNAEUS, THE YELLOW FEVER MOSQUITO, IN OKLAHOMA

During the later part of September, five adult specimens of *Aedes aegypti* were identified from mosquitoes submitted to the Oklahoma State Health Department from Muskogee County, Oklahoma. These mosquitoes, four females and one male, were collected by Mr. Robert Coker, a collector for the Malaria Control program operated by the Oklahoma State Health Department and the U. S. Public Health Service. This new distribution record is the westernmost occurrence of the species at this northerly latitude. Although the areas near the collection locations offered ideal breeding places for *A. aegypti*, investigations revealed no larvae.—Burton B. Hodgen, Malaria Control Entomologist, Oklahoma State Health Department.

THE TROPICAL RAT MITE IN KANSAS

On March 12, 1943, we received specimens of *Liponyssus haco'a* (Hirst) from Mr. E. E. King of Herington, Kansas. He reported that this mite had invaded part of a dwelling and that its bite is worse than that of any mosquito or ant ever was. Since this is our first encounter with this mite in Kansas and since it is a possible vector of endemic typhus fever, we feel that this note is worth recording. Doctor H. E. Ewing kindly confirmed my identification.—H. B. Hungerford.

NEW MOSQUITO RECORDS FOR COLORADO

During the summer of 1941, 407 adult mosquitoes were reared and pinned from larval collections obtained in the vicinity of Fort Logan, Colorado. The larvae were collected from ponds, lakes, irrigation ditches, and seep holes.

I wish to express my appreciation and thanks to Dr. Cornelius B. Philip of the Rocky Mountain Laboratory of Hamilton, Montana, for the determinations. The new distribution records for Fort Logan are: *Aedes dorsalis* Meig., *A. trivittatus* Coq., *A. vexans* Meig., *Culex tarsalis* Coq., and *Theobaldia inornata* Will.

Similarly, larval collections from Colorado Springs, Colorado, were made during the summer of 1942, and 131 adults were reared and pinned from these collections. The adults were determined by Dr. Maurice T. James, formerly of Colorado State College, to whom I am greatly indebted. The seven new mosquito distribution records for the Colorado Springs region are: *Aedes dorsalis* Meig., *A. triseriatus* Say, *Culex tarsalis* Coq., *C. territans* Walk., *Theobaldia incidens* Thom., *T. inornata* Will., and *T. impatiens* Walk.—Roland W. Portman, University of Missouri.

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Correction: *Dikraneura hyaline* on page 58 should be
Dikraneura hyalina.

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Number 1

DESCRIPTIONS OF SOME NEW NORTH AMERICAN PSYLLIDAE WITH NOTES ON OTHERS

LEONARD D. TUTHILL

Iowa State College, Ames, Iowa

Several new species of Psyllidae have come to hand since the preparation of the author's Monograph of the Psyllinae and Triozinae of America North of Mexico.¹ These are principally from material received from Montana State College and Massachusetts State College. These new forms are here described and new locality records and notes are given for some previously known.

*Psylla rara*² n. sp.

(Figs. 7, 8, 13)

Length to tip of folded wings 3.75 mm.

Color: General color fulvous. Five more or less distinct darker bands on mesoscutum. Venter often darker. Forewings with black spot at apex of clavus.

Structure: Head deflexed. Vertex $\frac{2}{3}$ as long as wide, discally depressed. Genal processes large, acute, nearly as long as vertex (longer than its median length), slightly divergent. Antennae not quite twice as long as width of head, terminal setae very prominent. Thorax well arched. Forewings large, broad, about $2\frac{1}{4}$ times as long as wide, membrane thickly set with minute setae, costal margin setate; Rs slightly sinuate, Cu₁ strongly arched, pterostigma large, opaque. Hind wings large, minutely setate. Hind tibia with small basal spur.

Genitalia: Male genitalia moderately large. Proctiger long, parallel sided, straight to near apex, then abruptly bent caudad. Forceps shorter than proctiger, in lateral view slender, straight, tapered apically; in caudal view slender, parallel sided, arched to blunt black apices, large setae on inner margins. Female genital segment large, stout; dorsal valve longer than ventral, slender apically, blunt; ventral valve slightly upturned, acute.

Holotype, female, **allotype**, male, Huntington Ravine, White Mountains, New Hampshire, Sept. 4, 1940, altitude 3400 feet, J. F. Hanson. **Paratypes** as follows: one male Tuckerman's Ravine Trail, White Mountains, N. H., 4200 feet, Sept. 3, 1940, J. Hanson; one male Highlands, North Carolina, 4000 feet, June 11, 1940, C. P. Alexander; one female Smoky Mountains, Tennessee, 4000 feet, June 5, 1939, C. P. Alexander; two females Halifax, July 7, 1921.

¹ Iowa State College Journal of Science 17 (4):443-660, 1943.

² rarus-a-um, L. adj.—few in number, rare.

The holotype, allotype and paratypes are in the author's collection. Paratypes are also in the Mass. State College collection and the U. S. National Museum. The Halifax specimens are from the U. S. National Museum.

No host data are available for this species. It apparently is confined to some plant which occurs only at higher altitudes in the mountains of the eastern United States but should be more widespread in Canada. The specimens from Halifax were set aside several years past in the hopes that more specimens would be encountered. In the first of two shipments from Massachusetts State College three more specimens turned up and with two additional specimens at hand it is now being described as new. The author has hesitated so long in describing it as it has so few distinctive characters. It resembles *P. mali* more than any other species known to occur in North America. The much larger genal processes and the spot at the tip of the clavus will serve to distinguish it from *mali* however. It runs to the latter species in the author's key (op. cit.)

***Psylla stricklandi* (Caldwell)**

In the Iowa State College collection there is one female specimen of this species from Blasdell, New York. It bears the date 7-15-92. Although undoubtedly of this species it differs from the western specimens by having antennae slightly over twice as long as the head.

***Trioza sinuosa*³ n. sp.**

(Fig. 6, 10)

Length to tip of folded wings 3.5 mm.

Color: General color fulvous, abdominal tergites brown. Forewings yellowish, most heavily along veins.

Structure: Head broader than thorax, Vertex deeply impressed, margins prominent. Genal processes large, stout, acute, scarcely divergent, nearly as long as vertex (longer than median length). Antennae 1½ times as long as width of head. Thorax broad, moderately arched. Pronotum depressed below plane of vertex. Forewings short, slightly over twice as long as wide, scarcely angulate, membrane thick; Rs long, sinuous, marginal cells small, radular areas unusually prominent. Hind wings large, thickly set with minute setae, somewhat rugose. Hind tibia with serrate basal carina, two inner apical spines. Metacoxae somewhat produced anteriorly, truncate.

Genitalia: Female genital segment much shorter than rest of abdomen; dorsal valve blunt apically; ventral valve shorter than dorsal, blunt.

Holotype, female, Jaffrey, New Hampshire, May 30, 1940, J. F. Hanson; one paratype same data; one, Great Gulf Trail, White Mts. New Hampshire, June 1, 1940, 1500 ft., J. F. Hanson; one, Limerick Mills, Maine, May 31, 1940, J. F. Hanson. Holotype and paratype in author's collection. Paratypes in Mass. State College collection and U. S. National Museum.

In general form this species resembles *T. tripunctata* but differs mark-

³ *sinuosus*-a-um, L. adj.—sinuous.

edly in the immaculate forewings, the larger genal processes, the wing venation and the genitalia. There is no indication of host plant in the data at hand.

***Trioza styliifera* Patch**

Numerous specimens of this species have been taken in the White Mountains of New Hampshire. Unfortunately no host plant data are available. The previously known collections were made at Brockville, Ontario and Herchmer, Manitoba.

***Trioza pletschi* n. sp.**

(Figs. 1, 1a, 2, 12)

Length to tip of folded wings 3.5 mm.

Color: Male dark brown. Margins of vertex, median line on prescutum light. Legs lighter. Female testaceous, two brown spots on prescutum, indistinct lines on scutum. Dorsum of abdomen dark brown.

Structure: Head small, narrower than thorax. Vertex depressed discally, margins raised. Genal processes $\frac{2}{3}$ as long as vertex, acute, somewhat divergent. Antennae slightly over twice as long as width of head. Eyes small. Thorax strongly arched. Pronotum strongly descending, not entirely below plane of vertex. Forewings $2\frac{1}{2}$ times as long as wide, rounded apically; veins heavy, Rs long, sinuate, marginal cells of moderate size, radular areas unusually prominent. Hind wings large, minutely setate. Hind tibia with serrate basal carina, two inner apical spines.

Genitalia: Male proctiger large, short, caudal lobes as long as axial portion. Forceps enclosed by caudal lobes of proctiger, in lateral view very stout, sharply bent cephalad to acute apices; in caudal view stout, swollen basally, narrowed apically; in dorsal view apices produced latero-cephalad as blunt tooth, mesal margin sharp, black margined. Apical segment of oedagus much enlarged apically, scoop shaped, a smaller lobe basally. Female genital segment short; dorsal valve blunt, black tipped, slightly down-curved apically; ventral valve shorter than dorsal, stout, upcurved, blunt.

Described from 33 specimens collected at Fairy Lake, Gallatin County, Montana, September 4 and 10, 1939 and 1940 by D. J. Pletsch on *Thalictrum occidentale*.

Holotype male, **allotype**, female, in author's collection.

Paratypes in Montana State College and author's collections.

Almost all of the specimens are quite teneral so the color description can not be given with accuracy. This species keys out to *T. singularis* in the author's key (op. cit.).

It may be distinguished from the latter by the rounded forewings, the longer radial sector and the male genitalia as figured.

It is with pleasure that the author dedicates this species to D. J. Pletsch, the collector.

***Trioza robusta*⁵ n. sp.**

(Figs. 4, 5, 9)

Length to tip of folded wings 3.5 mm.

Color: General color orange red. Antennae, genal cones, legs, thoracic venter and abdomen darker with light markings.

Structure: Head large, as wide as thorax. Vertex with discal foveae and medial suture prominent. Genal processes conical, somewhat divergent, $\frac{2}{3}$ as long as vertex. Antennae somewhat over $1\frac{1}{3}$ times as long as width of head. Thorax quite well arched. Pronotum on same plane as vertex. Forewings angularly rounded, about $2\frac{1}{2}$ times as long as wide, cubital cell larger than medial. Hind tibia with serrate basal carina, three inner apical spines. Metacoxae somewhat produced anteriorly.

Genitalia: Male proctiger nearly triangular in lateral view, caudal lobe not as long as axial portion, curved dorsad. Forceps about $\frac{1}{2}$ as long as proctiger; in lateral view stout, rounded apically and produced cephalad to sharp points; in caudal view stout, straight, narrowed and incurved apically, apical portion black. Female genital segment shorter than rest of abdomen; dorsal valve strongly concave dorsally, apical portion attenuate, blunt, slightly longer than ventral; ventral valve thick dorso-ventrally, dorsal margin convex, covering central portion of dorsal valve in lateral view, apex acute and slightly upturned.

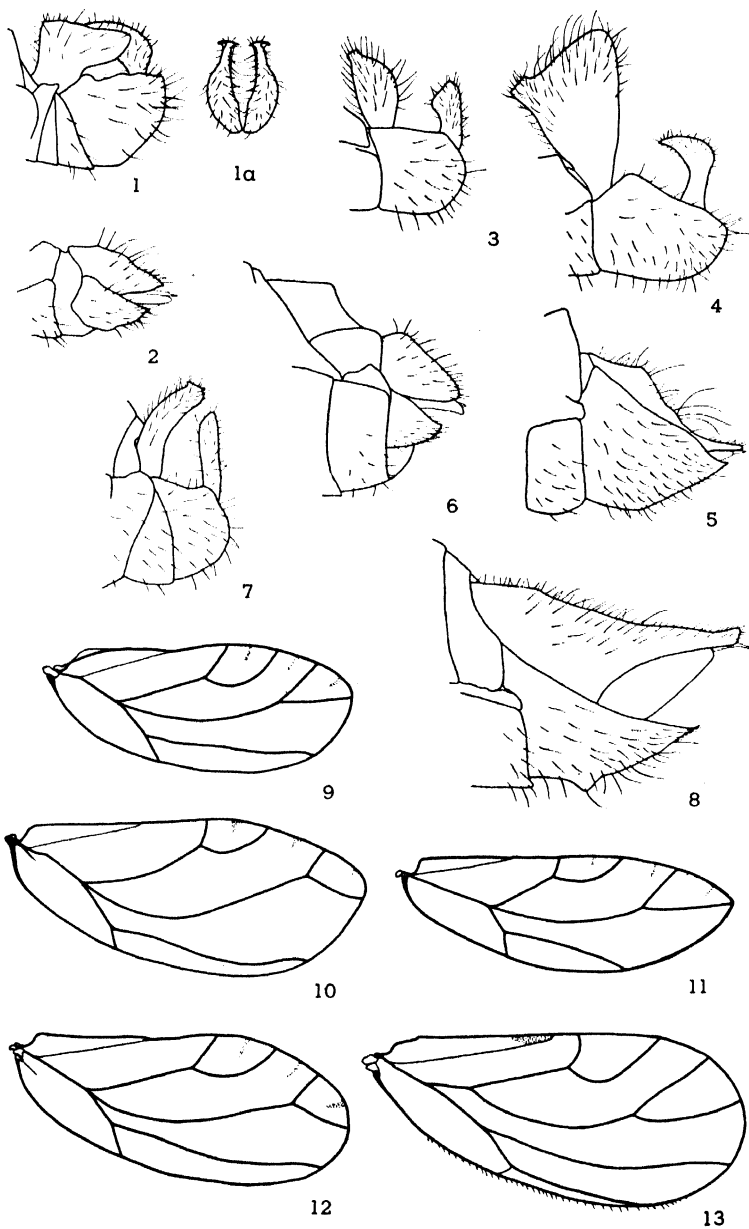
Holotype, male, Spring Hill, Gallatin County, Montana, Oct. 17, 1940, D. J. Pletsch; **allotype**, female, Langohr's Meadow, Middle Creek, Gallatin County, Montana, Oct. 7, 1939, D. J. Pletsch; 2 male and 3 female paratypes same data as allotype. All specimens taken on Douglas fir. One female paratype, Haugan, Montana, Aug. 9, 1931, R. H. Beamer. Holotype, allotype and paratypes in author's collection, paratypes in Montana State College collection and Snow Collection, University of Kansas.

This species is in the *T. frontalis* complex and resembles the latter very much. In the author's key (op. cit.) it runs to *T. sembla* Caldwell which it resembles in type of male genitalia. The accompanying figures will serve

⁵ *robustus*-a-um, L. adj.—robust, strong.

EXPLANATION OF PLATE

1. *Trioza pletschi*, lateral aspect of male genitalia.
- 1a. *Trioza pletschi*, caudal aspect of male forceps.
2. *Trioza pletschi*, lateral aspect of female genital segment.
3. *Rhinopsylla caldwelli*, lateral aspect of male genitalia.
4. *Trioza robusta*, lateral aspect of male genitalia.
5. *Trioza robusta*, lateral aspect of female genital segment.
6. *Trioza sinuosa*, lateral aspect of female genital segment.
7. *Psylla rara*, lateral aspect of male genitalia.
8. *Psylla rara*, lateral aspect of female genital segment.
9. *Trioza robusta*, forewing.
10. *Trioza sinuosa*, forewing.
12. *Trioza pletschi*, forewing.
11. *Rhinopsylla caldwelli*, forewing.
13. *Psylla rara*, forewing.



to distinguish it from the latter. Although all the specimens at hand were taken on Douglas fir it is almost surely an *Amelanchier* inhabiting species as are its close relatives. Its occurrence on Douglas fir, so late in the fall, very possibly indicates hibernation on that plant.

***Trioza aylmeriae* Patch**

Three specimens are at hand from N. Cottonwood Canyon, Gallatin County, Montana, collected May 11, 1940, by D. J. Pletsch. These specimens are identical with others from Maryland. Known heretofore from Ontario, Maryland and Ohio.

***Rhinopsylla caldwelli* n. sp.**

(Figs. 3, 11)

Length to tip of folded wings 3.25 mm.

Color: General color fulvous. Eyes and clypeus dark. Wings hyaline.

Structure: Head large, nearly as wide as thorax, scarcely cleft anteriorly. Vertex broad, strongly impressed discally, medial suture strong. Eyes small, hemispherical, lateral, not extending forward. Genae roundly produced, as in *Kuwayama*. (Antennae missing). Clypeus large, extended, plainly visible from front. Thorax moderately arched. Prothorax very narrow, depressed below plane of vertex. Prothoracic episterna strongly produced, collar like. Forewings slender, angulate apically, 3 times as long as wide; costal margin strongly curved; Rs short, very slightly sinuate; medial cell larger than cubital. Hind wings slender, exceeding abdomen. Hind tibia with large basal spur, one outer and two inner apical spines. Metacoxae produced anteriorly.

Genitalia: Male proctiger arcuately produced on caudal margin, with a distinct apical epiphysis, longer than forceps. Forceps in lateral view spatulate, produced on cephalic margin midway; in caudal view stout, very slightly arched. Female unknown.

Holotype, male, Bonefish Key, Florida, Feb. 22, 1940, J. S. Caldwell. No host data. Type in the collection of J. S. Caldwell.

This unique male is undoubtedly related to the other species of *Rhinopsylla* although the genae are scarcely produced to give any appearance of a "cleft" head.

It is with great pleasure that I name this species for Dr. John S. Caldwell, the collector, a fellow psyllidologist and friend.

***Aphalara nebulosa kincaidi* Ashmead**

Five specimens of this distinctive species are present in the Massachusetts State College material. All were taken at the Dolly Copp Camp, White Mountains, New Hampshire, June 1, 1940, by M. A. Hanson. Heretofore recorded from Alaska, Alberta, Washington, California and Colorado.

***Psylla hamata* n. n.**

The name *Psylla uncata* Tuthill (Ia. St. Coll. Jour. Sci., 17: 498, 1943) is preoccupied by *Psylla uncata* Ferris and Klyver (Trans. and Proc. New Zealand Inst., 63: 53, 1932). The name *Psylla hamata* is proposed for *Psylla uncata* Tuthill.

LIFE HISTORIES AND CONTROL TESTS ON THREE INSECT
PESTS OF SKINS STORED IN THE TANNERY¹

FRED H. WALKER JR.

Boston, Mass.

Three species of insects were found feeding on skins at the A. C. Lawrence Leather Company, Peabody, Massachusetts. They were the hide beetle, *Dermeestes vulpinus* (Fab.); the webbing clothes moth, *Tineola biselliella* (Hum.); and the red-legged ham beetle *Necrobia rufipes* (De G.). The hide beetle was of the greatest importance because it occurred each year in large numbers; the webbing clothes moth was present in sufficient numbers to cause damage during one of the years, while the red-legged ham beetle was found each year but in such small numbers that it caused little damage.

The skins which are known as shearlings except those on which the insects were found the first year were all of foreign origin. The foreign skins were brought in for storage in tightly packed bales in the dry salted condition during the spring and summer months. The domestic skins on which the insects were found during the first year were dried at the plant, salted, tied in loose bundles and stored in large piles. To control the insects in these piles, it was necessary to place the bundles in rows of smaller piles. The stored skins were placed in rows two bales high with aisles between the rows. The re-piling and rearranging of the bales was done to permit the entrance of some light and air into each bale or bundle. This arrangement made it possible to observe the amount of damage in each bundle and number of insects present. It also made the application of control measures easier.

THE HIDE BEETLE (*DERMEESTES VULPINUS* FAB.)

The hide beetle is a cosmopolitan insect found throughout the United States and shows marked preference for skins. Certain merchants of London years ago offered a prize of 20,000£ for a "practical and effective remedy," for this pest. When cargoes of goat and other skins arrive in this country from Mediterranean regions, Australia and some South American countries, the damage is sometimes so extensive that the skins are refused entry. It is also a troublesome insect in establishments dealing in dried animal, dried fish and raw fertilizer materials.

The beetle which is oval in shape and robust, ranges from $\frac{3}{8}$ " to $\frac{1}{2}$ " in length and is reddish brown in color. The head is small and recedes ventrally. The thorax is not prominent and segmentation is indistinct on the ventral surface of the abdomen which is covered with grayish hairs.

The beetles are strong, active fliers and feed on a great variety of flowers and shrubs. They frequently gain entrance to buildings by flying through

¹ The author is indebted to the A. C. Lawrence Leather Company, Peabody, Massachusetts for whom this work was done and with whose permission it is published.

windows and other openings, or they may be brought indoors on flowers. This beetle may be found in some heated buildings at any time during the year, but they are usually more abundant during the spring and summer months. The anthrax bacillus may be taken into the digestive tract on food and passed through with no injury to the organisms.

DAMAGE TO SKINS

Both the larvae and beetles feed, but the greatest amount of damage is done by the larvae. The beetles were first found during these observations on a large pile of skins but were not noticed in large numbers until they began appearing on the outside of the pile, where they ate long, shallow furrows on the flesh side of the skins. The larvae fed on the flesh side of the skin away from the light. The younger larvae preferred the thick, greasy portion of the skin where they were found in colonies. The eggs probably had been deposited there. The larvae ate out channels on the flesh side of the skin and, in many places, penetrated through to the grain, but there was no feeding on the grain or in the wool. The damage was most severe in the thick, greasy parts of the necks, shanks and bellies. Damage extended to the bottom of the pile but it was confined to the edges of the skins even where they were not tightly packed. Neither the larvae nor the beetles were ever found inside of bales or in the center of bundles, but they were always present in the greatest numbers, just inside the pile away from the light on both damp and dry skins.

Both beetles and larvae were found weeding on a shipment of dry, salted skins from which the wool had been removed previous to shipment from Australia. The skins were prepared for shipment by piling them after butchering and allowing them to heat, causing bacterial action which loosened the wool and permitted its removal. The skins had been dried and tied in loose bundles with naphthalene added and then shipped. The damage was so severe, especially to the grain because of penetration from the grain to the flesh side of the skin that they could only be used for inferior grades of leather.

LIFE HISTORY OF THE HIDE BEETLE

The life cycle of the hide beetle requires 60 to 70 days at average temperatures and humidity. The adult stage lasts for about 60 to 90 days and during which time they feed on skins. They are not negatively phototropic and may be found at windows trying to get outdoors to the flowers and shrubs. They are often found burrowing in the wool on the skins but no damage to the wool could be found. They mate and deposit their eggs in this stage. Actual oviposition was not seen. The eggs are laid on or near their food and require from three to ten days to hatch.

The newly hatched larvae are about $\frac{1}{8}$ " in length and are nearly all deep reddish-brown in color. They seem to occur in colonies within the fatty portion of the skin. They remain in this stage for about six weeks and molt six times at about 5 to 8 day intervals, with an increase in size at

each molt. As the larvae increase in size, the whitish segmentation and mid-dorsal line becomes more apparent. The cast skins found among the skins are often mistaken for live larvae. During the larval stage they show definite negative phototropism and when they are exposed to light immediately seek shelter and darkness. In cases of adverse conditions they are known to remain in the larval stage from 1 to 3 years.

The larvae range in size from $\frac{1}{8}$ " in length in the first instar to $\frac{1}{2}$ " for the full grown larvae. The ventral surface is white and above there is a mid-dorsal line running from the reddish-brown head to the tapering tip. This line is nearly white but with a slight reddish tint. Each segment being reddish brown which is the predominating color of the larvae. The segmentation of light reddish-brown shows up most prominently in the advanced stages. The larvae is covered with reddish-brown hairs on which they carry debris. They can move with great rapidity propelling themselves with a smooth, rapid crawl.

Pupation takes place in or on the food. Pupae are often found in the wool and in the burrows often partially within the last cast skin. This insect will frequently pupate within lumps of salt in a burrow made by the larvae. The pupae are white in color and show little activity even when disturbed. The pupal stage lasts from 10 to 11 days. The newly emerged beetles are nearly white in color.

FOOD OF THE HIDE BEETLE

Confining beetles and larvae on different kinds of leather and skins gave the following results:

Chamois: Twenty-five beetles and ten larvae were confined with a piece of chamois on which they remained alive for only two weeks and damage to the skin was slight.

Suede: Twenty-five beetles were placed on this leather and they all died after doing little feeding.

Cowhide: Twenty-five beetles were placed on a piece of damp cowhide and all died in a short time, but when the hide was dried, another twenty-five were introduced and they all thrived.

Wet Shearling: Twenty-five beetles introduced on a piece of wet shearling all died in a short time without feeding.

INSECTICIDE TESTS AGAINST THE HIDE BEETLE

Fly Spray: Twenty-five beetles were thoroughly covered with "Flit" spray and, after eight hours, all the beetles were dead. The spray had little effect on them when first applied.

Orthodichlorobenzene: Twenty-five beetles were thoroughly covered with a spray of this material and after 10 to 15 minutes all were dead. The beetles showed discomfort from the instant they spray contacted them and the larvae curled up and died in a short time.

FUMIGATION TESTS

Crystals of paradichlorobenzine took much longer to volatilize than the liquid orthodichlorobenzine. These two fumigants were used in different areas with skins both covered and uncovered and at different concentrations of fumigants. Best results were obtained when orthodichlorobenzine was poured over the skins after which they were covered with paper. Only a few of the beetles succeeded in crawling outside the paper. In isolated and thoroughly covered piles, a concentration of two pounds per ten cubic feet was sufficient to obtain complete control.

Tests were conducted with orthodichlorobenzine and Dowfume 75 at room temperature (70°F) with a 24 hour exposure in sealed one gallon containers. The concentrations were reduced until both fumigants were only partially effective.

Material	Concentration	Adults	Larvae	Alive	% Kill
Dowfume 75	1-18,927	20	3	1 adult	95
Orthodichlorobenzine	"	20	3	0	100
Check	---	20	3	all	0
Food Added					
Dowfume 75	1-18,927	20	0	0	100
Orthodichlorobenzine	"	20	0	0	100
Check	---	20	0	all	0
Food Added					
Dowfume 75	1-37,854	10	0	7	30
Orthodichlorobenzine	"	10	0	4	60
Check	---	10	0	all	0

In the above tests, orthodichlorobenzine proved to be the most effective fumigant.

Skins stored in bales were fumigated with 66⅔% ethylene dichloride and 33⅓% carbon tetrachloride by volume or 61.5% to 38.5% by weight. The amount of fumigant used was 560 pounds of ethylene dichloride and 349 pounds of carbon tetrachloride making a total of 909 pounds of fumigants. The area fumigated consisted of 130,500 cubic feet. Six pounds per thousand is usually the recommendation. The room was then sealed after the liquid had been poured over the tops of the bales and the skins were exposed to the fumigant for 47 hours. The room was then opened and a check made to determine the effectiveness of the fumigant. The results proved to be unsatisfactory because many of the beetles and larvae were still alive.

The same room was fumigated 13 days later with the temperature maintained at 100 degrees so as to volatilize the fumigant and activate the insects. The fumigants used were applied at three different intervals, first, 300 pounds of paradichlorobenzine was used; twenty-four hours later 300 pounds was added and then ten days later 150 pounds of orthodichlorobenzine was used. The method of fumigating consisted of pouring the ortho-

dichlorobenzine over the tops of the bales and placing the crystals of para-dichlorobenzine under the burlap which covered the bales. After the skins were exposed to the fumigant for seven days a check was made as to effectiveness, the results were regarded as satisfactory since the kill was about 90%. This fumigation proved effective, although the concentration used was less than recommended.

METHODS OF CONTROL USED AGAINST THE HIDE BEETLE

The method of control finally adapted included the use of both a contact insecticide and a fumigant. The bundles were re-piled in smaller piles or, in the case of bales, placed in rows to allow for the penetration of a general fumigant and to reach each bundle or bale with a spray. The bundles were packed in piles with orthodichlorobenzine added at the rate of 3 pounds per cubic foot of skins. The fumigation either resulted in the death of the insect or drove them to the outside of the piles where they could be reached with a spray of orthodichlorobenzine. All openings within the area fumigated were closed up so as to confine the fumigant and insects and also prevent their spread.

Two other methods, namely, the use of lights at night and baits were tried but without success. Hydrocyanic acid gas was not used because of the danger to persons entering the room and leakage to other rooms, although it is a very satisfactory fumigant and is the one most often used on pests of stored products.

GENERAL RECOMMENDATIONS FOR THE CONTROL OF THE HIDE BEETLE

1. Prevention of an infestation.

a. Sanitation: Have place of storage cleaned before the skins are brought in. If beetles are present, fumigate or thoroughly clean the cracks and crevices in the wall and floor.

b. Mechanical exclusion: Have stored skins protected from the outside by screened windows and closed doors thus preventing the insects present from spreading or others from gaining entrance. If it is necessary to store infested skins, they should be isolated from other skins.

c. Proper storage: Skins should be piled in small piles 6 to 8 feet high and 3 to 4 feet wide if in bundles and if in bales should be placed in rows to permit access to each bale. This makes it possible to check the skins to see if insects are present before they become numerous and also permits the penetration of a fumigant if fumigation becomes necessary.

2. Control of an infestation:

a. Remove and put into process all infested skins at once, if possible. Care should be taken when moving the skins to prevent the infestation of other areas.

b. Fumigation should be done with a fumigant that has high killing

power and good penetration. Orthodichlorobenzine and paradichlorobenzine was used because they were safer.

THE WEBBING CLOTHES MOTH (*TINEOLA BISELLIELLA* HUM.)

This insect is well known as a pest of wool, feathers, dried insects, and nearly all animal products such as bristles, dried hair and leather. Fabrics injured by the clothes moth have holes eaten in them and, in most cases, the presence of the insect is indicated by silken threads over the surface of the material. This insect was found in the wool of the shearlings but no damage was found on the skin itself. Materials left undisturbed for some time or stored in dark places are more severely injured by these pests. Infestation of the shearlings took place previous to storage at the plant.

The moths which probably takes no food of any sort lay their eggs singly on the products on which they feed. Each female lays from 100 to 150 eggs. The eggs are small, about the size of the head of a pin of $1/50$ inch long and are white in color. The larvae are white and vary in size from $1/16$ inch long when first hatched, up to and over $1/4$ inch when full grown. The length of the larval life varies from eight weeks to four years, according to the conditions and food supply. Upon completion of their growth, the larvae change to white pupae about $1/16$ inch long. The pupae turn brown in a few days and the adults emerge in three to four weeks. In heated buildings, the adults may be found at any time of the year, but are most abundant during the summer months. They began appearing in the shearlings late in July and emergence continued until late in the fall.

CONTROL OF THE MOTH

The control of the webbing clothes moth involved first, a light spray of orthodichlorobenzine, applied well into the bales to drive out the moths or put them to flight. Within a short period of time, a second spray was used to contact those which were in flight or those driven out to the surface of the bales. This method proved effective as evidenced by the numbers of dead moths at the base of the bales. It is also advisable to cover thoroughly the base of the bales for the second spray.

THE RED-LEGGED HAM BEETLE *NECROBIA RUFIPES* (DEG.)

This insect belongs to the family Cleridae. The genera of this family are all predators with the exception of one genus *Necrobia*, which in all stages lives on carrion. The insects in this genus are known as "bone beetles" because they are usually found on saprophagous material after most of the flesh is gone, probably feeding on larvae of other insects in the same material.

The red-legged ham beetle is a cosmopolitan insect and is found feeding on drying meats, carrion, bones, fish, cheese and is especially destructive to stored hams. This insect does not attack paper, therefore materials wrapped in paper are protected.

These beetles were not present in sufficient numbers to do any damage, but in captivity they did considerable damage to the flesh side of the shearlings. About 50 to 75 beetles and several larvae were found well down in the pile between bundles on the flesh side of the skins. When they were exposed to light both stages showed decided negative phototropism.

The adults are from $3/16$ inch long to $1/4$ inch long and from $1/16$ to $1/8$ inch wide. The dorsal portion including the head, thorax and elytra is a metallic blue-black. They have prominent red legs. The beetles are more active than *D. vulpinus* but not so robust. The head does not recede ventrally and they have distinct divisions between the head, thorax and abdomen.

The eggs are about $1/4$ inch long and hatch into white grubs which have brown heads. When the larvae mature, they reach the length of $1/2$ inch. They have a narrow brown head, a brownish body covered with tufts of short bristles and bear two horny protuberances on the terminal segments. The larvae are able to live two months without food. When they are disturbed or exposed, to light, they move with great rapidity for shelter. When ready to pupate, they make a curious and interesting cocoon in a rather novel way. They leave the fatty portion of the ham and gnaw their way either to the harder more fibrous parts of the ham or to a nearby beam. Here they make glistening white cocoons that resemble paper. The cocoon is not made of silk as is the characteristic of most insects, but it is composed of small globules of salivary secretions from the mouth of the insect. These globules adhere to each other and when they dry form the paper like cocoon.

It is stated in the literature that these insects are predacious in habit and feed on the larvae of insects which feed on the same foods, but during these observations they were not attacking the larvae of the leather beetle even when they were found in isolated areas.

The life cycle according to Dr. O'Flaherty is very similar to that of *D. vulpinus*, requiring about 100 days for its completion.

CONCLUSIONS

Of the three insects found feeding on skins, only one, the leather beetle caused losses. The webbing clothes moth was present in sufficient numbers to cause damage during one of the seasons, while the red-legged ham beetles were present in such small numbers that they caused little damage. The leather beetle was a pest on all dried skins if they remained stored for any length of time.

This work was carried on primarily to perfect control measures suitable to this particular situation, but while this was being done observations were made as to their life history and habits. The insecticides used for the control of these insects had to be non-poisonous when applied to the skins and the fumigant had to be as safe as possible as other floors in the same building were in use. They must not be injurious to the skins or

the leather making process unfavorably affected. The fumigant had to have a high killing power with good penetration. From the results of tests made on different materials, orthodichlorobenzene was used as a contact insecticide with paradichlorobenzene as a fumigant. These control measures have only temporary value, for if the skins are exposed outdoors for any period of time during the warmer months of the year they may become re-infested.

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DISTRIBUTION AND HOSTS OF ARKANSAS PHYLLOPHAGA (Coleoptera, Scarabaeidae)¹

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Forty-four species of Phyllophaga are known to occur in Arkansas. Their distribution within the state, their seasonal distribution, the adult host

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plants, and their occurrence at light, is the subject of this report. Such information is an essential preliminary for the development of measures for control of a group that includes a large number of species, several of which may be abundant in one region and whose biologies and habits may differ.

This report is based upon records of more than 16,000 adult *Phyllophaga* the great majority of which were collected from 1938 to 1942. The principal methods of securing adults were by collecting them on host plants, at light, removing from soil, and by rearing from collected grubs and pupae.

Of the forty-four species of *Phyllophaga* known to occur in Arkansas, seven have been previously recorded from the state. It is to be expected that after more extensive records have been made a number of additional species will be found, for some have a range that may include Arkansas.

Most of the collections of *Phyllophaga* that have been made in Arkansas have been rather local and for the most part have come from the north-western, southwestern, and east central sections. Consequently the relative numbers of species from these regions are greater than in other sections. Twenty-five species have been taken in Washington County, and twenty-two in Crawford County. Both counties are located in the northwestern part of the state. Thirty additional counties have records of one to sixteen species each. Notwithstanding the greater number of species recorded from Washington County, which is located in a hilly region, individuals appear to be less numerous than in the lowlands or river bottoms.

RELATIVE ABUNDANCE AND SEASONAL DISTRIBUTION

Table I includes all of the species of *Phyllophaga* now known to occur in Arkansas. The number of specimens of each species collected is indicated, and the earliest and latest dates of collection for each where known are given.

The total for each species, followed by a plus sign, indicates the minimum number of specimens collected or observed. In some cases, many more individuals of some species were observed on host plants and at light than indicated, but representatives only were taken.

The earliest and latest records in the state for the active occurrence of *Phyllophaga* adults are March 11 and September 6. No species is known to occur here throughout this period, but each is present during a particular part of the season.

Nine species have made their appearance in Arkansas in March, and fourteen, or more than one-third of the recorded species in the state, first appear in April. Others do not appear until May, June, or July.

SEASONAL ABUNDANCE

Many of the records in Table I were taken at irregular intervals, and it was not possible to indicate the period of greatest abundance for each

species. However, Table II shows the seasonal distribution and period of greatest abundance for sixteen species of Phyllophaga collected in a light trap in Washington County, Arkansas, during the seasons of 1941 and 1942.

TABLE I. Phyllophaga. Relative abundance and seasonal distribution of species in Arkansas

Species	Total collected	Earliest date taken	Latest date taken
<i>P. crassissima</i>	5,610+	April 25	July 29
<i>P. bipartita</i>	1,956	March 11	June 18
<i>P. ephil. virilis</i>	1,302+	June 8	Aug. 31
<i>P. fervida</i>	1,147+	March 25	June 7
<i>P. praetermissa</i>	1,000+	March 24	May 23
<i>P. submucida</i>	1,000+	June 14	Sept. 6
<i>P. tristis</i>	685+	March 21	May 23
<i>P. arkansana</i>	418+	March 28	May 30
<i>P. profunda</i>	281+	March 11	July 17
<i>P. prunina</i>	202+	March 25	June 28
<i>P. micans</i>	178+	March 21	June 12
<i>P. crenulata</i>	121	March 30	Aug. 18
<i>P. delata</i>	101+	May 10	June 14
<i>P. forbesi</i>	91	June	July 18
<i>P. fraterna</i>	57	April 12	June 12
<i>P. implicita</i>	49	May 15	July 12
<i>P. congrua</i>	46	April 26	May 1
<i>P. horni</i>	29	April 19	May 19
<i>P. longitarsa</i>	29	June 18	July 18
<i>P. apicata</i>	20	April 26	May 8
<i>P. calceata</i>	17	April 9	May 18
<i>P. balia</i>	17	April 20	May 23
<i>P. vehemens</i>	14	April 1	May 17
<i>P. ilicis</i>	13	April 15	July 18
<i>P. sylvatica</i>	11	April 21	April 26
<i>P. forsteri</i>	10	June 9	
<i>P. karlsioei</i>	10	April 2	May 21
<i>P. quercus</i>	8	July 13	July 23
<i>P. rugosa</i>	6	June 21	July 10
<i>P. parvidens</i>	6	April 25	
<i>P. sacoma</i>	5	May 4	
<i>P. hirticula</i>	4	April 27	June 14
<i>P. gracilis</i>	4	June 14	July 18
<i>P. diffinis</i>	4	April 7	May 8
<i>P. vanalleri</i>	4	June 2	June 14
<i>P. angulata</i>	3	July 12	Aug. 4
<i>P. hirtiventris</i>	3	June	July 12
<i>P. anxia</i>	3	May 17	May 29
<i>P. futilis</i>	2	May 9	
<i>P. marginalis</i>	1	May 2	
<i>P. drakei</i>	1	June 4	
<i>P. aemula</i>	1	July 18	
<i>P. barda</i>	1	May	
<i>P. perlonga</i>	?	?	

Sixteen species of *Phyllophaga* were taken in the light trap in Washington County during the seasons of 1941 and 1942. The first species appeared in April and records for the last species were in August. Several species occurred in considerable numbers over a period of two or three months. With the exception of *P. crenulata* (Froel.), which was collected over a period of four months, all other species had a seasonal distribution in this locality of one to three months. Most of the species occurred in May, and the total number of individuals of all species collected during this month exceeded the totals for April, June, July, and August combined.

DISTRIBUTION AND HOST RECORDS OF PHYLLOPHAGA

In the following discussion under each species of *Phyllophaga*, the counties from which the species was collected are given. Various plants on which the adults have been observed feeding are also indicated. Additional information is given for some species especially concerning their occurrence at light, observations of adult injury, and previous records of occurrence in Arkansas.

P. crassissima (Blanch.). Recorded from Washington, Crawford, Franklin, Logan, Pope, Pulaski, Clark, Jefferson, Arkansas, and Lee counties. More adults of this species have been collected in Arkansas than of any other *Phyllophaga*, and it has been one of the dominant species in white grub collections. Although occasional adults have been found feeding on elm, blackgum, and cultivated roses, the principal hosts were observed to

TABLE II. *Phyllophaga*. Seasonal abundance of species taken in light trap in Washington County, Arkansas, 1941 and 1942*

Species	Number collected each month				
	April	May	June	July	August
<i>P. fervida</i>	619	462	5	0	0
<i>P. tristis</i>	67	34	0	0	0
<i>P. bipartita</i>	253	382	0	0	0
<i>P. balia</i>	6	0	0	0	0
<i>P. fraterna</i>	1	0	0	0	0
<i>P. horni</i>	1	13	0	0	0
<i>P. arkansana</i>	1	82	0	0	0
<i>P. prunina</i>	0	7	4	0	0
<i>P. karlsioei</i>	0	1	0	0	0
<i>P. micans</i>	0	4	0	0	0
<i>P. profunda</i>	0	89	61	7	0
<i>P. crassissima</i>	0	2,866	1,623	59	0
<i>P. crenulata</i>	0	18	11	3	1
<i>P. praetermissa</i>	0	1	0	0	0
<i>P. ephil. virilis</i>	0	0	24	194	22
<i>P. forsteri</i>	0	0	1	0	0
TOTAL	948	3,959	1,729	263	23

* Total species and records for the two seasons combined.

be weeds especially the primrose *Oenothera lacinata*, Carolina cranesbill, buckhorn plantain, and curly dock. Also collected at light.

P. bipartita (Horn). Collected in Washington, Crawford, Franklin, Pope, Faulkner, Sevier, Miller, Hempstead, Nevada, Clark, Arkansas, and Desha counties. This species and *tristis* (Fab.) are the dominant oak feeding species so far collected. Taken on willow oak, post oak, black oak, Spanish oak, white oak, pecan, walnut, Chinese elm, wild plum, winged elm, blackberry, hawthorne, persimmon, pine, and cultivated roses. Abundant at light.

P. ephilda virilis Rein. Recorded from Washington, Crawford, Independence, Craighead, Hempstead, Arkansas, and Lee counties. This species has been collected and observed in considerable numbers especially on oaks and elm. Smaller numbers have been taken on hickory, wild grape, and hackberry. Also collected at light. This species and *submucida* (Lec.) were observed in July defoliating isolated elms near Batesville in Independence County. These two species have occurred later in the season in Arkansas than other Phyllophaga.

P. fervida (Fab.). Collected in Benton, Washington, Crawford, Polk, Miller, Hempstead, Nevada, and Faulkner counties. This species is one of the earliest to appear in the state, and nearly all of the individuals recorded were taken at light. It has been collected sparingly on pecan, blackgum, walnut, ash, oak, and persimmon.

P. praetermissa (Horn). Recorded from Washington, Crawford, Franklin, Logan, Miller, Hempstead, and Arkansas counties. This species is especially abundant at the Fruit and Truck Branch Experiment Station in Hempstead County where it was found feeding especially on elm and several species of oaks. It caused considerable damage to several rose varieties at this station feeding on foliage and floral parts. The adult host plants are willow oak, post oak, black oak, Spanish oak, white oak, overcup oak, elm, blackgum, wild plum, blackberry, hawthorne, and persimmon. Also collected at light.

P. submucida (Lec.). Collected in Benton, Crawford, Hempstead, Searcy, and Independence counties. Most of the specimens collected were taken in and near Batesville in Independence county where they were observed defoliating isolated elms. Also found in large numbers at light in Batesville. Other host records were hickory and hackberry.

P. tristis (Fab.). Recorded from Benton, Washington, Crawford, Franklin, Polk, Hempstead, Nevada, Bradley, Randolph, Independence, and Lee counties. This is a widely distributed species and probably occurs throughout the state. Most of the adults collected were taken on various species of oaks. Other host plants are pecan, persimmon, and cultivated roses. Also collected at light.

P. arkansana (Schffr.). Described from a male collected in Arkansas (Schaeffer, 1906) without indication of definite locality. It has since been collected in Benton, Washington, Crawford, Franklin, Logan, Pulaski, Polk,

Hempstead, Miller, and Union counties. Although most of the specimens were taken at light, adults have been collected on blackgum, sweetgum, and pecan.

P. profunda (Blanch.). Recorded from Washington, Crawford, Franklin, Logan, Sharp, Randolph, Lee, Arkansas, Desha, Bradley, Union, Nevada, Hempstead, Sevier, and Miller counties. Specimens have been collected on pecan, willow oak, black oak, post oak, white oak, blackjack oak, persimmon, sassafras, hickory, cultivated roses, hackberry, and at light. Although relatively few individuals of this species have been collected in the state, it is widely distributed and occurs on a variety of plants. This species and *bipartita* (Horn) are the earliest appearing species in the state.

P. prunina (Lec.). First recorded by Linell (1896) from Garland County. It has since been collected in Benton, Washington, Crawford, Franklin, Sharp, Randolph, Independence, Polk, Sevier, Miller, Hempstead, Clark, Ouachita, Union, and Bradley counties. It has been collected in the state on pecan, willow oak, black oak, pine, elm, cultivated roses, and at light.

P. micans (Knoch). Recorded from Washington, Crawford, Franklin, Sharp, Lee, Desha, Jefferson, Bradley, Clark, Hempstead, and Miller counties. It has been collected on sweet gum, black gum, pecan, elm, persimmon, and at light. Persimmon appeared to be a favored host.

P. crenulata (Froel.). Collected in Washington, Crawford, Franklin, Logan, Independence, Sharp, Lee, Jefferson, Desha, Chicot, Bradley, Ouachita, Clark, and Polk counties. It has been taken on pecan, black gum, black locust, elm, broadleafed plantain, curly dock, and at light. One specimen was taken in July at light on Mt. Magazine in Logan County. This is the highest point in the state with an elevation of 2,835 feet.

P. delata (Horn). Recorded from Pulaski, Arkansas, Drew, Clark, and Hempstead counties. Adults have been collected on willow oak, red oak, elm, hickory, pine, and sassafras.

P. forbesi Glas. Collected in Independence, Craighead, Lee, and Arkansas counties. It has been taken on apple, pecan, poplar, sycamore, black locust, hackberry, and at light.

P. fraterna Harris. Recorded from Washington, Crawford, Jefferson, and Hempstead counties. It has been collected on black gum, post oak, blackjack oak, and at light.

P. implicita (Horn). Collected in Franklin, Independence, Lee, and Chicot counties. Host plants for this species are black locust, willow, pecan, poplar, and sycamore. Also collected at light.

P. congrua (Lec.). Recorded from Washington, Crawford, and Franklin counties. Oak is the only known food plant for the species in the state. Also taken at light.

P. horni (Smith). Collected in Washington and Desha counties. No hosts are known for this species in the state. The recorded specimens were taken at light.

P. longitarsa (Say). Collected in Washington, Crawford, Independence, Lee, and Chicot counties. Specimens have been collected in the state on willow, poplar, sycamore, and at light.

P. apicata Rein. Recorded only from Crawford, Montgomery, and Miller counties. Specimens were taken only on oak. This species was originally recorded from Texas and Caddo Gap in Montgomery County, Arkansas. (Reinhard, 1939). It was described as a subspecies of *tristis* (Fab.) but is believed by the author to be a distinct species.

P. calceata (Lec.). Collected in Crawford, Franklin, Logan, and Arkansas counties. Specimens were collected on oak and at light.

P. balia (Say). Recorded from Washington, Crawford, Carroll, and Polk counties. It has been collected in the state on red oak, hickory, and at light.

P. vehemens (Horn). Collected in Washington, Crawford, Franklin, Lee, Bradley, Hempstead, and Miller counties. The few specimens taken were dug from soil or collected at light.

P. ilicis (Knoch). Recorded from Washington, Franklin, Sharp, Independence, Polk, and Clark counties. Collected on elm and at light.

P. sylvatica Sand. Arkansas was one of the original states from which the species was described (Sanderson, 1942). Collected in Washington and Crawford counties on persimmon, oak, and at light.

P. forsteri (Burm.). Collected only in Washington and Franklin counties. The few specimens collected were dug from soil and taken at light.

P. karlsioei (Linell). Described from a male and female collected at Hot Springs, Arkansas (Linell, 1896) in Garland County. Also found in Washington, Franklin, Clark, Hempstead, and Miller counties. The few specimens taken were collected on black gum, pecan, and at light.

P. quercus (Knoch). Collected only in Washington and Independence counties. One live adult and fragments of another were taken in July under leaves in oak-hickory woods. A few specimens were taken at light.

P. rugosa (Melsh.). Recorded from Washington and Sharp counties. No hosts are known in the state for this species, and most of the specimens were taken at light.

P. parvidens (Lec.). Collected once in the state at light in Union County.

P. sacoma Rein. Described from Texas and Arkansas (Reinhard, 1939). Recorded only from Nevada County.

P. hirticula (Knoch). Collected in Benton, Nevada, Jefferson, and Drew counties. The few specimens recorded were taken on pecan, blackgum, and at light.

P. gracilis (Burm.). Recorded from Independence and Hempstead counties. A few specimens were taken on oak.

P. diffinis (Blanch.). Specimens were collected in Washington, Lawrence, and Miller counties. Collected on oak and at light.

P. obsoleta vanalleri (Schffr.). This is the only species of the subgenus

Phytalus recorded from the state. A few specimens have been collected at light in Crawford, Lee, and Ouachita counties.

P. angulata Glas. Three specimens were collected in Independence and Arkansas counties at light.

P. hirtiventris (Horn). Recorded only from Lee and Arkansas counties. Collected at light.

P. anxia (Lec.). The three specimens collected were taken in Sharp, Lee, and Arkansas counties. No information accompanied the specimens concerning hosts.

P. futilis (Lec.). The two specimens taken were collected at light in Hempstead County.

P. marginalis (Lec.). One specimen was taken in Searcy County.

P. drakei (Kby.). One specimen collected in Washington County.

P. aemula (Horn). A single specimen was collected in Crawford County on willow oak.

P. barda (Horn). One specimen was taken in Randolph County at light.

P. perlonga Davis. This species was described from Arkansas, Mississippi, and Tennessee (Davis, 1920). The Arkansas material was taken in Clark County, and no additional specimens have been collected in the state.

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A NEW SPECIES OF ACINOPTERUS FROM CALIFORNIA

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Acinopterus parallelus Beamer, new species

Related to *A. brunneus* Ball but smaller, gray in general color instead of brown, margins of vertex more nearly parallel and basal processes of aedeagus much longer and more slender. Length male 5, female 6 mm.

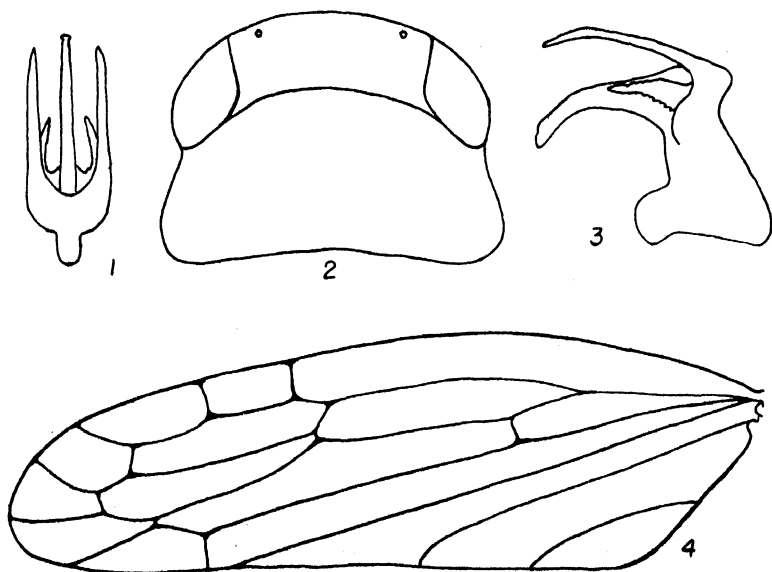
Head about as wide as pronotum, very short; vertex with disc broadly and shallowly excavated, margins practically parallel, about three times as wide as length at middle; elytra with mesal margin rounding before apex.

Color: Cinereous with veins more or less bordered with fuscous; males darker than females. Both sexes heavily pruinose throughout. Dorsum of abdomen black extending around more or less to venter with some blackening of legs.

Genitalia: Last ventral segment of female about two and one-half times as long as preceding, lateral angles broadly rounded, posterior margin greatly produced with semblance of a median notch. Aedeagus in ventral view with two pairs of processes, outer pair almost as long as shaft, quite slender, inner and lower pair about half as long as shaft, thicker, margins more or less serrate; in lateral view, shaft sharply curved dorsally on outer fourth; processes roughly paralleling shaft except not radically bent on outer fourth.

Holotype male, allotype female, 21 male and 18 female paratypes, Fillmore, California (Ventura County), June 11, 1942, H. H. Severin.

The almost parallel margin of the vertex of this species gives it its name and will separate it from other known species.



1 Dorsal view of aedeagus. 2 Head and pronotum. 3 Lateral view of aedeagus. 4 Wing.

TWO NEW SPECIES OF THE LAXITAS COMPLEX FROM
MEXICO

(Hymenoptera, Eurytomidae)

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In a manuscript, which is awaiting publication, there is a table summarizing 31 new species of the genus *Eurytoma* from Mexico described by the author since 1941. Since the preparation of the table some additional material has yielded two more new species. Both new species, described below, belong to the *Laxitas* complex of the *Mucronura* group (Bugbee 1941). *Eurytoma laxitas*, a third member of this complex, was described in the paper mentioned above. The discovery of the two new species raises the total number of new species from Mexico to 33. A re-description of the *Laxitas* complex is necessary as formerly the complex was based only on *E. laxitas*. The re-description follows:

MUCRONURA GROUP

Laxitas Complex (Bugbee 1941)

Female: Length, 4.1-7.9 mm.; average 5.56 mm. This complex contains some of the largest species in the whole genus *Eurytoma*. Abdomen, deeply oval in outline from the side and dorsally arched; extremely laterally compressed; width, from above, averages .96 mm. (range .65-1.4 mm.); depth, from the side, averages 1.96 mm. (range 1.4-2.7 mm.); thus the depth is equal to about twice the width; scaling on lateral aspect of segment 6, coarse, and it covers whole width of lower third of segment; recedes dorsally toward anterior margin; covers about $\frac{1}{2}$ to $\frac{3}{4}$ of whole surface: posterior dorsal margin of segment 6 deeply emarginate; white pile covers segments 7 and 8 and posterior half of exposed tips of dorsal valves (9th abdominal segment); these valves long and pointed; average in length .80 mm. (range .45-1.2 mm.); valves project upward forming an angle of 45 to 50 degrees with the longitudinal axis of the abdomen; proximal half of valves naked and smooth or lightly shagreened; distal half pitted and covered with bristles; spiracle raised and in middle of a circular, triangular or elliptical area; segment 6 at its widest point averages .86 mm. (range .62-1.17 mm.) while segment 5 at its widest point averages .49 mm. (range .25-.87 mm.); thus segment 6 is about 1.7 times the width of segment 5. Genitalia average about 3.5 mm. in length (range 2.7-5 mm.) and 2.2 mm. in height (range 1.7-3.2 mm.); dorsal valves uniformly narrow for horizontal length; turn dorsally anteriorly at right angles and bend slightly backward; ventral vales turn dorsally anteriorly also and expand into a broad plate which bends backward upon itself; stylet arch in a vertical plane; angle formed by the horizontal and tangent lines ranges from 40 to 50 degrees. Thorax with the tegulae yellowish brown to black. Propodeum with a median depression

which maybe same width for entire length or slightly wider at top than bottom; central ridge straight and distinct only at top of median depression; rest of depression cut up into small square to rectangular areas; at base of depression is a narrow crescentic pit; areas lateral to depression with irregular pits and ridges. Legs with coxae black; femurs black or dark brown with yellow outer tips; tibiae also black medially with tips yellow; tarsi white; legs well covered with silvery white pile which is thickest on hind tibiae. Head narrow from above and flat across face; eyes bulgy laterally. Scape of antennae black, except for extreme base which may be brownish yellow to reddish brown. Wings average in length 3.9 mm. (range 2.8-5.5 mm.) veins light to dark brown in color; and not overly heavy for such large species; marginal vein averages in length .54 mm. (range .37-.75 mm.) and the postmarginal averages .25 mm. (range .17-.37 mm.); thus the marginal is more than twice the length of the postmarginal; stigmal club rectangular in shape with bottom gently rounded. Wing-body ratio of 1.46 (range 1.37-1.55).

Hosts: *Amphibolips* species of the niger complex on black oaks (*Quercus incarnata*, *Q. Edwardi* and *Q. fulva*).

Range: West central part of Mexico in the states of Durango and Zacatecas.

Altitude: 7000-8500 feet.

The *Laxitas* complex may be told from the *Mucronura* complex by the much greater depth and different shape of the abdomen; more elongate posterior tips of the dorsal valves; deep emargination of the posterior dorsal edge of segment 6; the distinct host species; greater size and narrow 6 abdominal segment in relation to the width of segment 5.

The two new species which comprise the *Laxitas* complex, along with *E. laxitas*, are described below:

Eurytoma plana, n. sp.

(*Mucronura* Group; *Laxitas* complex)

Female: Length averages 4.4 mm. (range 4.1-4.7 mm.). Abdomen deeply oval in outline and laterally compressed; depth from the side averages 1.5 mm. (range 1.4-1.6 mm.); width from above averages .70 mm. (range .65-.77 mm.); thus depth is twice the width; 9th abdominal segment (exposed tip of dorsal valves) averages .56 mm. in length (range .45-.60 mm.); basal half shiney but surface finely shagreened; posterior half covered with silvery white pile; spiracle raised on a circular eminence in the center of a circular depression; dorsal valves along with ventral valves project upward forming a 45-50 degree angle with the longitudinal axis of the abdomen; lateral surface of 6th. abdominal segment coarsely scaled or pitted for whole width from base to about middle of segment; beyond middle sculpturing fades out dorsally but reaches almost to dorsal aspect of segment along anterior border of segment; no white pile on segment 6 but thinly scattered over surfaces of segments 7 and 8; width of 6th abdominal segment at its widest

point averages .70 mm. (range .62-.77 mm.) and the 5th at its widest point averages .32 mm. (range .25-.37 mm.); thus the 6th is about twice the width of the 5th. Genitalia average 2.7 mm. in length and 1.7 mm. in height; dorsal valves, anterior to exposed tip, uniformly narrow for horizontal length; turn dorsally, anteriorly, at right angles; ventral valves turn dorsally also anteriorly, and expand into a broad plate which bends backward on itself; stylet arch in a vertical plane; angle formed by the horizontal and tangent lines equals 40 degrees; whole structure similar in proportions to *E. laxitas*. Thorax with the tegulae yellowish brown. Propodeum with rather shallow median depression which is about same width for entire length; central ridge irregular, with numerous short lateral ridges which divide area up into many small square to rectangular areas on each side of central ridge; at base of median depression is a curved, narrow pit or depression, succeeded by a convex area with surface lightly shagreened; areas lateral to median depression irregularly punctate; resembles most closely *E. laxitas*. Legs with coxae black; femurs black to dark brown except tips which are yellowish brown or lemon yellow; tibiae with some black to brown infuscation medially; tarsi white; white pile on femurs and tibiae thin; heaviest on hind-tibiae. Head, from above, with a flat face; eyes somewhat bulgy laterally; scape of antennae black except for brownish tinge to extreme base in a few. Wings average in length 3.0 mm. (range 2.8-3.1 mm.); veins light brown in color and not heavy; marginal vein averages .43 mm. in length (range .37-.45 mm.) and postmarginal averages .21 mm. (range .17-.25 mm.); thus marginal is twice the length of postmarginal; stigmal club rectangular in shape with a rounded bottom. Wing-body ratio averages 1.46.

Male: Length equals 3.1 mm. As there is only one male no further description is considered worth while.

Types: 6 females and 1 male. Holotype female, and paratypes of both sexes in author's collection.

Type Locality: Labels read, Otinapa, State of Durango, Mexico, 8500 feet elevation. Galls collected on November 14, 1931; males and females emerged summer of 1932.

Hosts: Labels read, from galls of *Amphibolips* (niger) *niger* Kinsey, on *Quercus incarnata*. For description of the host gall maker see Kinsey 1937, pages 443-444.

Range: Known only from Otinapa in the southwestern portion of the State of Durango.

E. plana is very close to *E. laxitas* (Bugbee 1941). The differences between the two species are chiefly in averages. *E. laxitas* averages larger than *E. plana* and this is carried over into a longer 9th, abdominal segment, marginal vein and depth and width of the abdomen.

The two species are found in the same locality although on different species of hosts on different species of oaks. *E. laxitas* occurs on *Amphibolips* (niger) *jubatus* Kinsey (1937) on *Quercus fulva*, a small scrub tree,

while *E. plana* occurs on *Amphibolips (niger) niger* Kinsey (ibid) on *Quercus incarnata*, a big tree form of black oak.

Kinsey (1937) pages 440 and 444 does not find the two hosts of *E. laxitas* and *E. plana* as closely related as is indicated for the two parasitic species. *Amphibolips jubatus*, host of *E. laxitas*, belongs to one chain of species (*elatus-jubatus-maturus*) while *A. niger*, host of *E. plana*, belongs to another chain (*nebris-niger-pistrix*). Both chains are within the *Amphibolips niger* complex, however. Although the parasites follow, in general, the same evolutionary pattern as their hosts as far as the complex they fail to show the same split within the complex. Actually, according to Kinsey, the host of *E. plana* is more closely related to the host of *E. ingens*, n. sp. described further on in this paper. Strangely enough *E. ingens*, although well within the limits of the *Laxitas* complex, shows evidence, as outlined under the description of *E. ingens*, of representing a distinct evolutionary branch within the complex apart from *E. plana* and *E. laxitas*. Therefore the situation is reversed in the parasites. The following table will illustrate this further.

Arrangement according to

Host Relationships (Kinsey 1937)			Parasite Relationships (Bugbee 1941-44)		
Chain	Host	Parasite	Chain	Parasite	Host
I	<i>A. niger</i>	<i>E. plana</i>	I	<i>E. plana</i>	<i>A. niger</i>
	<i>A. pistrix</i>	<i>E. ingens</i>		<i>E. laxitas</i>	<i>A. jubatus</i>
II	<i>A. jubatus</i>	<i>E. laxitas</i>	II	<i>E. ingens</i>	<i>A. pistrix</i>

Thus, although the evolutionary paths of both hosts and parasites hold very close together down to the complex, within the confines of the complex they part company and each has taken a different path. This is but one of the many startling but intriguing phases of the study of evolutionary problems.

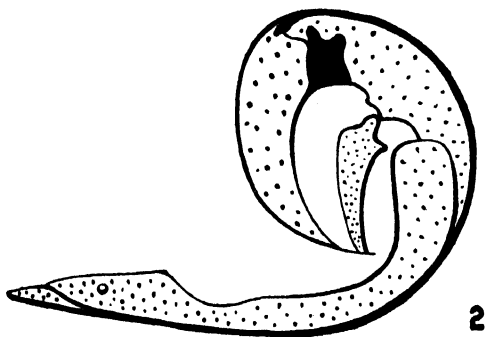
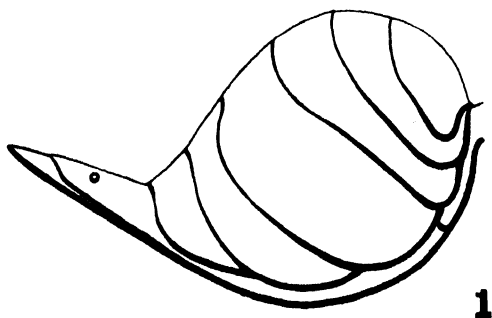
***Eurytoma ingens*, n. sp.**

(*Mucronura* Group; *Laxitas* complex)

Figs. 1 and 2

Female: Length ranges from 7-7.9 mm.; average 7.4 mm.; one of the largest species of the genus *Eurytoma*; only species approaching it in size is *E. gigantea*, Walsh. Abdomen extremely laterally compressed; dorsally arched; averages in depth 2.6 mm. (range 2.6-2.7 mm.); averages in width 1.3 mm. (range 1.3-1.4 mm.); thus the depth is twice the width; 9th abdominal segment (exposed tip of dorsal valves) long and sharply pointed; averages 1.2 mm. in length (range 1.12-1.22 mm.); proximal half shiny and smooth or only faintly shagreened; distal half pitted and covered with short bristly hairs; spiracle raised on an elliptical eminence and placed in center of triangular to elliptical depression with apex pointed backward; outer tip maybe reddish to deep yellowish brown; dorsal valves, along with ventral valves, stick upward at a 45-50 degree angle in relationship to longitudinal axis of abdomen; silvery white pile scattered thickly over segments

7 and 8; practically none on segment 6; segment 6 at its widest point averages 1.15 mm. (range 1.15-1.17 mm.) segment 5 at its widest point averages .78 mm. (range .70-.87 mm.); thus segment 6 averages only 1.47 times greater in width than segment 5; lower $\frac{1}{2}$ - $\frac{3}{4}$ of lateral aspect of segment 6 finely scaled or pitted; recedes dorsally toward anterior edge of segment but becomes coarser at base and covers whole surface of segment. Genitalia averages about 5 mm. in length and 3.2 mm. in height; dorsal valves narrow for horizontal length; turn dorsally anteriorly at right angles; ventral valves turn dorsally anteriorly also and expand into a broad plate which bends backward upon itself, thus forming a semi-circle; stylet arch in a vertical plane; whole structure massive; angle formed by the tangent and horizontal



EXPLANATION OF DRAWINGS

(For drawings insects enlarged to 150 mm.)

Fig. 1 Abdomen of *Eurytoma ingens* n. sp.Fig. 2 Genitalia of *Eurytoma ingens* n. sp.

lines equals 50 degrees. Thorax with the tegulae black to deep reddish brown. Propodeum with a narrow but distinct median depression; slightly wider at top than bottom; central ridge in upper $\frac{1}{3}$ of depression divides it into two large irregular rectangles; below large rectangles are several ridges running across width of depression, defining 3-4 small rectangles; below basal rectangle is a much deeper pit which is succeeded by a raised area whose surface is finely shagreened; areas lateral to median depression with irregularly punctations and ridges. Legs with the coxae black; all femurs solid black except for lemon yellow outer tips; tibiae with considerable black medially and tips lemon yellow to almost white; tarsi white; all legs well covered with silvery white pile; head narrow and very flat across front from above; eyes noticeably bulgy laterally; scape of antennae all black except for extreme base which may show trace of deep reddish brown. Wings average in length 5.4 mm. (range 5.2-5.5 mm.); veins dark brown; not very heavy for so large a species; marginal vein averages in length .70 mm. (range .65-.75 mm.) and the postmarginal averages .32 mm. (range .30-.37 mm.) in length; thus marginal is more than twice the length of the postmarginal; stigmal club is rectangular in shape with a flat or straight bottom. Wing-body ratio averages 1.37.

Males: Only one specimen of the two males is in fair enough condition to use. It measures 4.4 mm. in length.

Types: 6 females and 2 males. Holotype, female, and paratype females and males in the author's collection.

Type locality: Labels read, La Mesa, State of Zacatecas, Mexico, 7000 feet elevation. Galls collected on November 21, 1931; males and females emerged July, 1932.

Hosts: Labels read: from galls of *Amphibolips (niger) pistrix* Kinsey on *Quercus Edwardi*; Kinsey coll. and det. For description of gall maker see Kinsey 1937, pages 444-445.

Range: The host of *E. ingens* was collected from only the single locality (La Mesa), which is located in the southwestern portion of Zacatecas. Specimens of *E. ingens* are recorded from the same locality only.

Eurytoma ingens is the largest species so far described in the genus *Eurytoma*. It averages larger in length than *E. gigantea* (Walsh 1870) which held first place up to the discovery of *E. ingens*:

E. ingens displays a close affinity with the *Laxitas* complex of the *Mucronura* Group. This complex is composed of two closely related species i.e. *E. laxitas* (Bugbee 1941) and *E. plana*, described in this paper. *E. ingens*, on the other hand, although close to *E. laxitas* and *E. plana*, represents a different evolutionary trend within the complex. Its great size and especially the black tegulae set it apart from all other species of the *Mucronura* group which have brown tegulae. It does not seem wise to erect a new complex on the basis of the black tegulae which seems to be just another example of not being able to depend on what appeared at first to be a good

diagnostic character. The instability of this character is akin to the case of the typopygial spines in the subgenus *Atrusca* (see Kinsey 1936, pages 32-35). In all other characteristics *E. ingens* fits perfectly into the *Laxitas* complex. A fuller discussion of its relationship to the other species of the *Laxitas* complex follows the description of *E. plana*.

E. ingens is easily differentiated from other species of the *Laxitas* complex by its large size, black tegulae, greatly elongated 9th. abdominal segment, specific host and distribution.

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NOTES ON LEPIDOPTERA

DON B. STALLINGS AND DR. J. R. TURNER

Caldwell, Kansas

Isogramma hageni (Grt.)

This Sphingid is double brooded in Sumner County, Kansas. The first brood appears in May and the first part of June, while the second brood appears in August. There does not seem to be any particular character by which to distinguish the broods, other than the time caught.

The moth is rather a late flyer, usually not appearing until after 10 o'clock p.m. Central Standard Time and flying until one or two o'clock a.m. The food plant of the larvae is the common hedge tree (Osage Orange) and the adult is found flying the hedge rows common in this vicinity as fences around farms.

The egg is green and round. The larvae is green with a few light bluish bars along each side of the body, being very similar to the larvae of *Pholus achemon* (Dru.).

The distinguishing character of *Isogramma hageni* is the greenish suffusion over the fore-wings and body. We have taken two specimens in which the greenish suffusion was replaced with a rich golden brown suffusion. It may be noted that the green coloring in *Isogramma hageni* is a

fugitive color. Spread specimens several years old have a yellowish-green color rather than the deep green of fresh caught specimens.

***Melittia lindseyi* (B. & B.)**

This Aegeriid which was described from specimens taken in Seward County, Kansas, occurs in Sumner County, Kansas, and in Carson County, Texas.

This moth is usually observed flying around its food plant the common Stink Gourd (*Cucurbita foetidissima*). The weather conditions seem to have no effect on its flying habits as it can be collected on cool, cloudy days during a high wind and on bright, still days. The favorite habitat for this moth appears to be the open prairie country where the Stink Gourd is found.

The life-history, worked out by H. A. Freeman of White Deer, Texas, is as follows: After mating the females lay their eggs on the upper surface of the leaves and on the stems of the Stink Gourd. The females may employ two methods for oviposition. The first method and most common one is for the female to rest quietly on the upper side of the leaves and lay the eggs in that position. The other method used is for the female to dash from one plant to another depositing an egg here and there over the stems as well as the leaves. A single female may lay as many as 250 eggs. The size of the egg is 2 mm. long; 1 mm. wide and .5 mm. high. It is oblong in shape and flat on the top and bottom and is reddish-brown in color. This is the stage in which the insect overwinters. After the plant dies and scatters over the ground the eggs will remain in this position until the latter part of May or early June when they hatch. Soon after hatching the tiny larvae move to the young stems of the gourd plant and bore directly into the vines. Here they feed on the plant tissue and go through five molts. As the larvae increase in size their presence can be detected from the outside by a swelling of the vine, locally called "galls." After the larvae have obtained their full growth they make a hole on the ventral side of the vine and dig down into the ground for a depth of three inches immediately beneath the hole from which they emerged. The vacated vine or stem section may be swollen for a length of six inches and to a width of from two to two and a half inches in thickness. After the full larvae has bored into the ground it prepares an earthen cell about two inches long and an inch and a half thick inside which pupation takes place, by this time it is around the latter part of July (For Kansas the latter part of August). The insect will remain in the pupal stage until approximately the middle of August (In Kansas until the middle of September). Aided by a sharp cutting projection on the cephalic end the pupae cut their way out of the earthen cell and assisted by sharp projections on each segment that point caudad, they move upward to the surface of the ground. There the pupal skin splits at the cephalic end and the moth crawls out and promptly locates some nearby weed or bush on which it crawls. It then assumes an upsidedown position

and the wings rapidly expand and dry. The entire performance requiring less than two hours. After this the moth flies away to carry on in the same way as its parents. The species is single brooded.

Melittia snowi (Hy. Edw.)

The life history of this Aegeriid is almost identical with that of **Melittia lindseyi**, except of course the fact that the adult being much smaller than **lindseyi**, the egg and larvae of **snowi** are smaller.

Snowi feeds on the Stink Gourd as does **lindseyi**. The main difference in their life history being that **snowi** winters over in the cell, the adult emerging in June and July. The larvae leaves the Stink Gourd Vine in September and October to pupae in the ground. A few of the earlier larvae to mature will pupate and emerge in October but the vast majority will winter over in the cell to emerge the following June and July.

A REVISION OF NORTH AMERICAN OMPHRALIDAE (Scenopinidae)

D. ELMO HARDY

University of Kansas, Lawrence, Kansas

With the exception of the common "window fly" **Omphrale fenestralis** (Linn.) members of this family are not well known and are very poorly represented in collections. The writer has quite often encountered these interesting flies while sweeping grasses and other vegetation for Dorilaidae and with the aid of the University of Kansas Biological Survey party has been able to build up a comparatively large group of them in the Snow Entomological Collections. As far as is known the larvae are predaceous, some of them are no doubt of economic importance.

In most of the Omphralidae which have been studied the male genitalia are completely turned over so that the ninth tergum, cerci and anal region are situated on the venter and the coxopodites and clasping structures are dorsal in position. In *Pseudatrachia* the structures appear to be normal in position, while in all of the males of *Belosta* which have been studied the genitalia seem to be twisted to the side. In most genera the ninth tergum is folded around the genital structures and serves as a protective covering. The aedeagus is usually three pronged and the clasping structures are rather simple, usually poorly developed.

Key to North American Genera

- | | |
|---|-------------------------------|
| 1. Apical cell closed and petiolate | 2 |
| Apical cell open | 5 |
| 2. Body covered with scales | Metatrachia Coquillett |
| Body without scales | 3 |

3. Fork of vein R_{4+5} located at or beyond middle of apical cell (R_5); propleurae with a hirsute process on each side just above front coxae 4
Fork of R_{4+5} near base of apical cell; propleurae without such a process **Brevitrichia** n. gen.
4. Mouthparts well developed; palpi slender, arising on lateral margins of mouth; head longer than high **Pseudatrichia** Coquillett
Labellum scarcely visible, palpi thick and clavate in shape, arising near median portion of face; head slightly higher than long.
..... **Belosta** n. gen.
5. Body clothed with scales **Omphralosoma** Kröber
Body without scales **Omphrale** Meigen

Metatrichia Coquillett

Metatrichia Coquillett, 1900, Ent. News 11, 500.

Members of this genus resemble **Omphrale**, they are distinguished by the more robust body, more greatly arched thorax; by having the body clothed with bulblike scales; the apical cell (cell R_5) is closed and petiolate and the suture between the scutellum and the mesonotum is very narrow not wide and distinct as in other genera.

Genotype: **Metatrichia bulbosa** (Osten Sacken)

Metatrichia bulbosa (Osten Sacken)

Scenopinus bulbosa Osten Sacken, 1877, West. Dipt., 275.

This species is readily distinguished by the generic characters and has been adequately described by previous workers. It might be of interest, however, to note that the mouthparts are very well developed, filling the entire facial depression. The labellum is large and fleshy and extends to bases of antennae. The palpi are lateral in position, are long slender and flattened at apices, they extend almost the full length of the facial depression. The facial depression is deep, sides vertical; the portions of the face along the eye margins are very narrow.

This is the only species known from North America, the only other New World species is **M. robusta** Kröber,¹ described from Paraguay. **M. bulbosa** is a rather common and wide spread species throughout the middle west and western United States.

Type locality, Missouri. Type in Cambridge Museum of Comparative Zoology.

Specimens have been seen from Arizona, California, Kansas, Michigan, Missouri, Oregon, South Dakota and Texas.

Brevitrichia new genus

Related to **Pseudatrichia**, all of the described species have been placed in this genus. The known **Brevitrichia** are of smaller size, with rather broad, more robust bodies, especially in the males. The head is higher than long and the males are holoptic or nearly so. The antennae are broader and

¹ 1913, Kröber, Ann. Mus. Nat. Hist., 11, 180.

shorter with the two apical points more acute (fig. 4a). The third antennal segment is more thickened at base and tapered toward apex, scarcely two times as long as greatest width. The front is gradually sloped, never horizontal. The portions of face along the eye margins are very narrow and the facial depression deep with vertical sides. The mouthparts are well developed, filling one-half or more of the facial depression; the palpi are slender but short, extending about one-third the distance from the base of mouthparts to the antennae. Occiput weakly developed, rather narrow and never produced above the upper margin of the eyes. Propleurae with base of the apical cell (R_3) (fig. 4b); petiole of apical cell less than half out a hirsute development. Wings short, fork of vein R_{4+5} situated near the length of vein R_4 . Sides of abdomen rather straight, segments not dilated. The genitalia of both sexes are very different from *Pseudatrichia*, the females possess an apical circlet of spines and the males have large ventral plates surrounding the genital structures.

This genus appears to be related to *Pseudomphrale* Krober but doesn't fit his inadequate description.

Genotype: *Brevitrichia griseola* (Coquillett) (*Pseudatrichia*).

Key to North American *Brevitrichia*

1. Abdomen shining black with white lateral margins. Disc of scutellum black, margin yellow. Third antennal segment about two times longer than second *insulana* (Cole)
 Abdomen largely yellowish or white or with only markings of black; in the females sometimes light brownish. Third antennal segment four or five times longer than second 2
2. Legs chiefly brownish yellow; abdomen of male chiefly yellow to white *griseola* (Coquillett)
 Femora black, abdomen definitely marked with black
 *helenae* (James)

Brevitrichia griseola (Coquillett)

(figs. 4a, b)

Preudatrichia griseola Coquillett, 1900, Ent. News 11, 501.

This species is usually predominantly yellowish in color with the thoracic and abdominal markings brownish to black; the mesonotum is mostly black with lateral margins yellowish and with three faint grayish brown vittae. Hind portion of mesonotum usually with a large square shaped yellow spot medianly, this is partially to completely divided by a median longitudinal line of black; this portion varies from this condition to almost black. In some specimens yellowish striae extend from the hind portion of the mesonotum to or beyond the middle. The scutellum is chiefly yellowish with a black median spot of varying size. The legs vary from yellow to brownish and the abdomen is usually largely yellow with narrow brownish bands on anterior margins of segments.

The coloration seems extremely variable in this species.

Length male: body, 2.6 mm. to 2.8 mm.; wing, 2.0 mm. to 2.2 mm.

Length female: body, 3.6 mm. to 4.2 mm.; wing, 2.2 mm. to 2.4 mm.

Type locality, Mesilla, New Mexico. In U. S. National Museum.

This species is rather common in grassy situations in the West. Specimens are at hand from numerous localities in Arizona, California, Idaho, New Mexico and Texas. One female specimen has been studied (in U. S. National Museum) from El Rancho, Guatemala, El. 900 ft., Feb. 7, 1932 (C. N. Ainslie), this seems to compare in all respects.

***Brevitrichia helenae* (James)**

Pseudatrichia helenae James, 1938, Jour. Kans. Ent. Soc., 11, 22.

In his discussion of this species Dr. James states: "Related to ***P. griseola*** Coq., but smaller in size, the abdomen is definitely marked with black, the femora are black and the knobs of halteres are white." In a large series of ***B. griseola*** all of the above characteristics are covered by the variations. The color appears to be extremely variable and is not a consistent character. The specimens of ***B. griseola*** average the same size as ***B. helenae*** and a homotypic specimen compared in all respects. This is probably just a color variation but until more specimens have been examined it is perhaps best to retain its specific rank.

Type locality: Roggen, Colorado.

Type in collection at Colorado State College.

Specimens fitting ***B. helenae*** are on hand from Lusk, Wyoming, July 14, 1937 (R. H. Beamer, C. L. Johnson); Strasburg, Colorado, June 21, 1937, (R. H. Beamer); Leeds, Utah, Aug. 9, 1936 (R. H. Beamer) and Mountain Park, N. M., June 27, 1940 (R. H. Beamer).

***Brevitrichia insulana* (Cole)**

Pseudatrichia insulana Cole, 1923, Proc. Cal. Acad. Sci.

This species appears to be distinctive in having the abdomen chiefly shining black, the pleurae black with some yellow marks and the third antennal segment short compared to the length of the second. The antennae are black. The disc of the scutellum is black with the margins yellow. The dorsum of the thorax possesses three grayish brown vittae. The stems of halteres are brown and the knobs white. The femora and apical portions of tibiae blackish, the hind tibiae are largely yellow while the first two pairs are largely brownish.

Length of male, 2.75 mm.

Length of female, 5.8 mm.

Type locality: Mexico.

Type in the California Academy of Sciences. The writer has not seen this species.

Pseudatrichia Osten Sacken

Pseudatrichia Osten sacken, 1877, West. Dipt., 275; change of name for ***Atrichia*** Loew, 1866, Cent. 7, 76.

Members of this genus are rather large, very slender, metallic black or blue-black in color and almost devoid of conspicuous hairs. The head is longer or at least as long as high. Occiput swollen on upper portion, usually extending above the eye margin. Facial depression deep; sides of face along eye margin sharply sloped, almost vertical in the male. Mouthparts well developed, extending over half way to bases of antennae; palpi slender, extending almost to tip of labellum. Third antennal segment not greatly thickened medianly, usually about three times as long as wide, sides nearly straight (fig. 2a). Front horizontal, sloped only near the antennae. Propleurae with a warlike hirsute development on each side just above front coxae. Fork of R_{1+2} situated at or beyond the middle of apical cell (R_5). Petiole of apical cell, vein $R_5 + M_{1+2}$ over half the length of the free portion of R_5 . Wings slender, three to four times longer than greatest width. Abdomen elongate in both sexes, the segments slightly narrowed at bases so that they appear to overlap. The abdomen of both sexes has a pair of slightly raised velvety spots in middle of second tergum, these are surrounded by a polished area. The female genital structures are more strongly developed than those of the male and are without a circlet of spines at apex. The male structures are completely hidden within the eighth abdominal segment.

Genotype: *Pseudatrichia longurio* (Loew).

Key to North American *Pseudatrichia*

1. Legs brown to black, front opaque, larger species, 8.0 mm. in length **longurio** (Loew)
At least front legs and coxae, trochanters and tarsi of others yellowish; front polished, usually smaller species, 4.0-6.66 mm. 2
2. Middle and hind femora and tibiae black; head conspicuously longer than high; front of female rather narrow, not as wide as ocellar triangle; small species, 3.7 mm. in length **parva** n. sp.
Legs chiefly yellow; head about as high as long; front of female broad, much wider than ocellar triangle; larger species, 5.5-7 mm. 3
3. Second and third abdominal segments white on posterior margins, above and below **albocincta** Van Duzee
Abdomen without white margins on segments, although the conjunctiva is white **unicolor** Coq.

Pseudatrichia albocincta Van Duzee

Pseudatrichia albocincta Van Duzee, 1926, Pan. Pac. Ent., 2, 164.

This species is known only from the male, it is closely related to *P. unicolor* but appears to be distinct in having the second and third abdominal terga and sterna margined with white posteriorly. The head is about as high as long, front nearly horizontal. The body is chiefly black and the legs almost entirely yellow; palpi yellowish white; mesonotum with a small yellow spot back of humeri and another back of wings, these are connected by a narrow white line. Thorax and abdomen somewhat granulate, nearly

bare, apical portion of abdomen and genitalia with a few pale hairs. Knobs of halteres white. Wings hyaline, veins yellowish; the fork of vein R_{4+5} is located at the apical third of cell R_5 .

Length: body, 6.0 mm.; wing, 4.0 mm.

Type locality, Bradley, California.

Type in California Academy of Sciences. Dr. Edward S. Ross of the California Academy of Sciences has sent the writer information concerning the structural characters of the type.

***Pseudatrichia longurio* (Loew)**

***Atrichia longurio* Loew, 1866, Cent. 7, 76.**

This species should be readily recognized by its large size, its brown to black legs and opaque front. According to the original description the third antennal segment and the male genitalia are dark rufous; the humeri and scutellum yellowish or brownish; wings grayish hyaline, veins brownish.

Length 8.0 mm.

Type locality: Mexico.

Type in Cambridge Museum of Comparative Zoology.

The writer has not seen this species.

***Pseudatrichia parva* n. sp.**

(figs. 2a, b)

This species is related to ***P. unicolor*** Coquillett but is readily distinguished by its small size; elongate head and thorax; chiefly black legs and black conjunctiva, shorter more robust third antennal segment, narrower front of female, front distinctly raised, especially on lower portion; the mouthparts are more developed and the sides of face more narrow.

Female.—Head: Entirely black or brownish, excepting the reddish brown eyes. Head produced forward, about one-fourth longer than high; antennae situated at or slightly below the median portion of head as seen from side view (fig. 2a). Occiput strongly developed, swollen above and behind, upper portion developed into a ridge extending above the eye margin. Front narrower than ocellar triangle, slightly convex, especially on lower portion so that from lateral view the lower part projects out from the eye margin. The antennae are brownish black, covered with microscopic pubescence and a few fine hairs on second segment; third segment shorter, more broad than in any other *Pseudatrichia* known to the writer, it is about two times as long as its greatest width. The facial depression is deep with vertical sides; the sides of face extending horizontally from the eye margins are very narrow. Mouthparts well developed, filling most of the facial depression; palpi slender, extending about three-fourths the distance from the base of mouthparts to the tip of labellum. **Thorax:** Metallic black on mesonotum, brownish black on the sides. Almost devoid of pile; mesonotum finely rugulose. Thorax elongated, almost twice as long as high; mesonotum produced forward on anterior portion. Propleurae with a well developed tubercle above the front coxae. Stems of halteres brown, knobs

white. **Legs:** Front pair chiefly yellowish except for the brown apical portion of tarsi; femora and tibiae with a brownish tinge. Middle and hind legs chiefly dark brown to black, except for the yellow coxae, trochanters and basitarsi. All leg joints slender. Post tibiae as long as femora; basitarsi about equal in length to remaining subsegments. **Wings:** Fork of vein R_{4+5} situated beyond the middle of the apical cell; vein R_1 sinuate; vein $R_5 + M_{1+2}$ about equal in length to the free portion of R_{5+6} . Crossvein r-m situated at apical three-fourths of the discal cell (fig. 2b). **Abdomen:** shining brownish black with a slight brown tinge, more black on the margins of the sclerites. Entire abdomen finely punctulated. The dorsal marking of the second tergum mostly shining black. Abdomen bare except on genital portion. Genitalia well developed, thickly covered with paler hair, especially on the ventral portion.

Length: body, 3.7 mm.; wings, 2.7 mm.

Male unknown.

Holotype, female, Flagstaff, Arizona, July 8, 1941 (R. H. Beamer).

Type in Snow Entomological Collections.

***Pseudatrichia unicolor* Coquillett**

***Pseudatrichia unicolor* Coquillett, 1900, Ent. News, 11, 500.**

(fig. 3a)

This is a moderately large species characterized by its yellow legs and metallic black abdomen. The head is about as high as long, the occiput somewhat swollen above but not greatly so behind. Eyes of male narrowly separated on the front, front slightly less than the width of median ocellus; front of female broad, much wider than ocellar triangle, rather flat, not convex or produced below. Third antennal segment almost three times as long as wide. Thorax and abdomen chiefly metallic black, finely rugulose, pleurae brownish, humeri and posterior calli yellowish. Stems of halteres brown, knobs white. Legs yellow, tarsi brownish. Fork of R_{4+5} slightly beyond middle of apical cell (R_5) vein $R_5 + M_{1+2}$ shorter than free portion of R_{5+6} . Conjunctiva of abdomen white, terga with sparse recumbent pile, more noticeable on sides; posterior portion of abdomen and genitalia rather thickly pale haired. Male genitalia hidden inside of the eighth segment.

Length of male: body, 5.4-6 mm.; wings, 4.0 mm.

Length of female: body, 6.6-7 mm.; wings, 4.33 mm.

Type locality: Las Vegas, New Mexico.

Type in U. S. National Museum.

The writer has seen specimens from Cloudcroft and Alamogordo, New Mexico (these are the specimens recorded by Cresson²); from type locality, August 11, (H. S. Barber) and from Florissant, Colo., July 11 (S. A. Rohwer).

***Belosta* new genus**

In general body shape these flies resemble *Metatrichia* but the structural characters, aside from the shorter more robust body, show it to be

² 1907, Trans. Amer. Ent. Soc. 33, 113.

more closely related to **Pseudatrichia**. This genus is distinct from all genera of Omphralidae known to the writer by having atrophied mouthparts. It is distinguished from **Pseudatrichia** by having the head higher than long, instead of longer than high; the third antennal segment rounded at apex, not square tipped; mouthparts very inconspicuous and small, almost hidden by the palpi; palpi arising near median portion of face, clavate in shape and extending scarcely over one-third the length of the facial depression in the females (fig. 13a) and not quite one-third the length in the males. In **Pseudatrichia** the mouthparts are well developed, filling over half the facial depression, the palpi are long and slender, not enlarged apically; the palps are lateral in position and extend over one-half the length of the depression (fig. 13a). The facial depression is rather shallow in **Belosta**, in some females the face is scarcely concave; the sides of the face along the eye margins are almost flat in the females and gently sloped in the males; the occiput is not at all developed above. **Pseudatrichia** have a deep facial depression, the sides of face are sharply sloped so that the edges along the eye margins are rather acute; the occiput is developed above the eye height. The thorax of **Belosta** is strongly humped, the height is equal to its length and the mesonotum, mesopleurae and sternopleurae are densely haired except in **B. flaviceps** (Coq.). **Pseudatrichia** have the thorax longer than high and have only sparse microscopic pile. The front of females of **Belosta** is much more broad than in **Pseudatrichia**, that of the males is somewhat more narrow above; the abdomen is more broad, not so elongated and the genitalia of both sexes are very differently developed from the related genera.

Genotype **Belosta albipilosa** n. sp.

Key to Known Species of **Belosta**

1. Thorax distinctly pilose, thickly covered with neatly erect pile 2
Pile of mesonotum microscopic and recumbent **flaviceps** (Coq.)
2. Face and occiput of female chiefly yellow-white, facial depression of male mostly white around sides, front yellow at or near the antennae.
Thorax moderately pilose, pile entirely pale yellow **albipilosa** n. sp.
Front and face black, pile of mesonotum long, mixed black and white, posterior portion of mesonotum with two narrow streaks of golden pile narrowly separated by the black pile **pilosa** (Coquillett)

Belosta albipilosa n. sp.

Related to **B. pilosa** (Coquillett) but not so densely pilose, with yellow to white markings on the front and face of both sexes and the thoracic pile is entirely pale yellow. The genital structures of male are distinctive.

Female.—The following characters are supplementary to the generic description. Species chiefly shining black with pale pile. **Head:** Face and front, margin of occiput chiefly yellow-white; hind portion of occiput and lower part of face brownish black; face with a flat dark colored spot at lower margin of each eye. Front yellowish along the eye margins, brownish in

middle, ocellar triangle and antennae black. Facial depression largely white, the bottom portion brownish; palpi yellowish at bases, blackened at apices; the visible mouthparts are brownish black. Antennae finely pubescent, first segment very short, less than half the length of the second; the third segment is strongly thickened through median portion and rounded at apex (fig. 13b). The only visible mouthpart, aside from the appendages, appears to be just a small knoblike development between the palpi near their bases, this seems to be a rudimentary labellum, it is probably not functional. The palpi are short and thick, distinctly enlarged apically. Front broad, three times the width of the ocellar triangle. **Thorax:** nearly two times as thick dorsoventrally as the head is high; mesonotum strongly arched. Chiefly shining black in ground color, margins of humeri and the posterior calli yellowish white; pteropleurae yellowish brown, all of the revealed conjunctiva around wing base and bases of legs white. Propleurae with a wart-like process just above the front coxae, this is covered with fine pile. Stems of halteres dark, knobs pale. **Legs:** almost entirely black, knees narrowly yellow, all joints slender, femora scarcely swollen, tibiae straight. Posterior metatarsi slightly longer than rest of the tarsi. Pile entirely pale yellow. **Wings:** Entirely clear, veins brown. The apical cell (R_5) is closed and bears a long petiole, petiole nearly equal to the length of vein R_4 . The fork of veins R_4 and R_5 is situated beyond the middle of cell R_{5+6} . Crossvein r-m situated at apical three-fourths of discal cell. **Abdomen:** Rather broad and short, about three times longer than its greatest width; chiefly brownish black, with the apices of the terga and sterna narrowly white. All of the visible conjunctiva whitish; with sparse recumbent pile more abundant upon the sides. Apex of abdomen, genital portion, slightly enlarged.

Length: body, 5.3-6.0 mm.; wing, 4.0 mm.

Male.—Similar in most respects to the female. The head, excepting the red eyes, is chiefly brownish black with the front only yellow at or near the antennae; facial depression mostly white around the sides and dark in median portion. The front is narrowly separated above, the separation is less than the width of median ocellus. Thorax and legs somewhat more thickly haired, pile of abdomen more distinct. **Genitalia:** Not strongly swollen, the structures rather obscured in undissected specimens. The coxopodite is wider than long, rather sharply tapering on posterior median margin, the apex with a 'V' shaped cleft. The median portion of the coxopodite possesses a pair of comblike structures each made up of 12 to 13 strong spines arranged in a oblique row (fig. 13c). Clasping structures simple, folded inward in resting position and not visible except in direct end view; claspers curved outward (fig. 13d). Ninth tergum divided into two plates, these are much longer than wide and each terminate in a long slender apical lobe (fig. 13e). Cerci elongated, well developed.

Holotype, female, Riggins, Idaho, May 18, 1940 taken on *Pinus ponderosa* acc. No. 22070 Hopk. U. S. (T. Terrell). Allotype, male, and three paratypes, two males, two females, Prineville, Oregon, June 23, 1934, on

Pinus ponderosa, acc. No. 18960-75-a,b, Hopk. U. S. (W. J. Buckhorn). The holotype was reared from a log infested with *Monochamus* larvae, the allotype and paratypes were collected from trees killed by *Dendroctonus brevicomis* by placing fine mesh wire screens directly on the trunks of these trees and catching the insects in glass jars as they emerged. The larvae of this species are evidently predaceous upon bark beetles.

Holotype, allotype and two paratypes returned to U. S. National Museum, two paratypes retained in Snow Entomological Collections.

***Belosta flaviceps* (Coquillett)**

Pseudatrichia flaviceps Coquillett, 1903, Proc. U. S. Nat. Mus, 25, 102.

This species is distinguished from other known *Belosta* by having the thorax thinly pilose, the pile being recumbent and sparse. The humeri and the front and face are yellow and the antennae are chiefly yellowish. The occiput is black except for the yellow sides.

Length 3 mm.

Type locality, Williams, Arizona. Type in U. S. National Museum.

The writer has not seen this species. Comparative notes on it and *B. pilosa* have kindly been supplied by Mr. C. T. Greene of the U. S. National Museum.

***Belosta pilosa* (Coquillett)**

Pseudatrichia pilosa Coquillett, 1903, Proc. U. S. Nat. Mus., 25, 102.

The following descriptive notes were supplied by Mr. C. T. Greene. All hair on edge of mesonotum and pleurae long and white, pile in middle of mesonotum long, mixed black and white; in certain lights the posterior dorsal portion of mesonotum has two narrow streaks of golden pile, narrowly separated by the black pile. Halteres yellowish, with or without a brown infuscation. Thorax humped, the distance from the lateral suture to the top of the hump is equal to the width of the thorax from above. Abdominal segments 2-8 white on posterior and lateral edges.

Type locality, Williams, Ariz. Type in U. S. National Museum. The writer has not seen this species.

***Omphralosoma* Kröber**

Omphralosoma Kröber, 1937, Stett. Ento. Zeit. 98, 219.

This genus is closely related to *Omphrale*, it is distinguished by the presence of scales on the body. In other respects they are very similar to some of the small species of *Omphrale*. This is the first report of an *Omphralosoma* from the Western hemisphere. According to Kröber³ the genus has been known only from the genotype from Algiers.

Genotype, *Omphralosoma squamosa* (Villen).

Continued next issue

³ 1937, Stett. Ento. Zeit., 98, 214.

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Journal of the Kansas Entomological Society

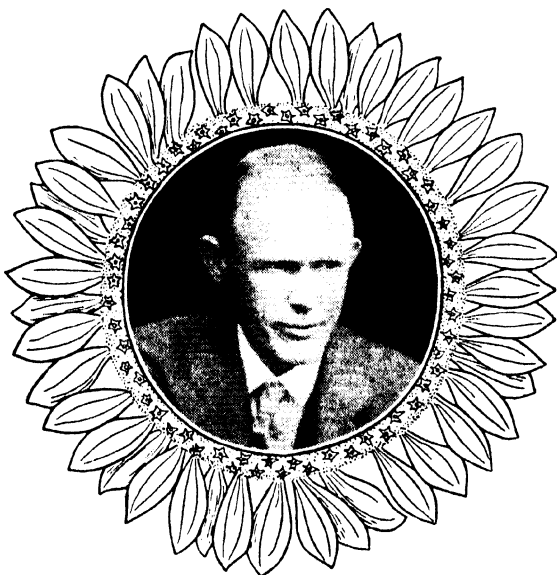
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Kansas Entomological Society

Volume 17

April, 1944

Number 2

(Continued from the January issue)

A REVISION OF NORTH AMERICAN OMPHRALIDAE
(Scenopinidae)

D. ELMO HARDY

University of Kansas, Lawrence, Kansas

Omphralosoma albifasciata n. sp.

(fig. 5a)

This species more nearly resembles *Omphrale mirabilis* (Adams) than any other American species of Omphralidae. It is readily distinguished from this by the vestiture of the thorax, by the short vein R_3 , by its smaller size and shorter abdomen of the female and by the broader white bands of male abdomen.

Male.—Chiefly polished black species, sparsely covered with scales on the thorax and with short yellow hairs on the abdomen and legs. **Head:** Almost hemispherical, higher than long from side view. Eyes divided into two portions by a differentiation in the size and color of the facets, on the lower one-third the facets are smaller in size and darker in color. Front polished black, eyes very narrowly separated, front extending to the ocellar triangle as just a thin line. Face shining black in ground color, covered with gray pubescence. Antennae brownish black, third segment about twice as long as first two, slender, not swollen, apex square (fig. 5a). Mouthparts black with a brown tinge. Sides of face sloped, mouthparts well developed, filling most of facial depression. Palpi slender, extending almost to the tip of labellum. **Thorax:** scales white, confined largely to the mesonotum. Knobs of halteres ivory-white, posterior edge of humeri faintly yellowish tinged, otherwise black. **Legs:** Coxae, trochanters and femora black, tibiae and tarsi yellow; extreme apices of femora often yellowish. **Wings:** Milky white, veins faintly yellowed, just slightly darker than the membrane. Vein R_3 scarcely longer than R_4 , and very faintly curved. Apical cell (cell R_5) rather widely open in the wing margin, the opening is about equal to the length of r-m crossvein. Crossvein r-m situated about twice its length from fork of M_1 and M_2 . **Abdomen:** Shining black, except for the ivory-white terga of segments three, four and five; these terga are entirely white except for very small triangles of black on lateral margins. **Genitalia:** Small and rather inconspicuous. Ninth tergum well developed, divided into two broad lateral plates; these plates extend around the genital structures to the venter; they are about two times as wide as long and are more produced on their dorsal and ventral edges. Cerci elongated, over two times

as long as wide. Coxopodite and clasping structures chiefly hidden by the overlapping ninth tergum. Claspers rather small and simple, strongly curved inwardly on apical portion.

Length: body, 2.3 mm.; wing, 1.7 mm.

Female.—Similar to male but the front is about twice as wide as the ocellar triangle, the tibiae are chiefly black, the wing veins are more brown, R_5 is slightly longer and the abdomen is without the white bands.

Length: body, 2.66 mm.; wing, 2.0 mm.

Holotype, male, Seeley, Calif., July 17, 1940 (R. H. Beamer). Allotype, female, Jacumba, Calif., Aug. 12, 1935 (R. H. Beamer). One paratype, male, same data as type.

Omphrale Meigen

Omphrale Meigen, 1800, *Nouvelle Classif.*, p. 29.

The member of this genus are robust in build, chiefly black in color and have the apical cell open in the wing margin, vein R_5 not joined with M_{1+2} . The third antennal segment is rather elongate, three to four times longer than wide, is rounded at tip and has a subapical depression on outer side. The head is higher than long and the front gradually sloped. The mouthparts are well developed, occupying most of the facial depression and the palpi extend nearly to tip of labellum. The abdomen is flat and board, scarcely longer than the head and thorax combined.

Genotype, **Omphrale fenestralis** (Linnaeus)

Key to North American Species of Omphrale

1. Eyes of male separated on the front by almost the width of the median ocellus, front of both sexes smooth and polished
.....(**Paraomphrale**) **glabrifrons** (Meigen)
Eyes of male contiguous, or nearly so; front finely rugulose and usually more dull. (**Omphrale**) 2
2. Femora reddish 3
Femora black 4
3. Front with a distinct median depression on the lower part
..... **cavifrons** Kröber
Front without such a depression but with a longitudinal furrow
..... **fenestralis** (Linn.)
4. Knobs of halteres white 7
Knobs brown to black 5
5. Abdominal terga of male three to five very broad, revealing just a narrow white band of conjunctiva; the terga are three to four times wider than the white bands **valga** n. sp.
Terga of segments three to five very narrow, these segments are almost entirely white 6
6. Wing veins brown (male) **nubilipes** (Say)
Wing veins hyaline **beameri fusca** n. var.
7. Third antennal segment four times as long as wide; antennae about as long as head width **electa** (Adams)

- Third antennal segment not over three times as long as wide; antennae about one half the head width 8
8. Apical cell widely open in the wing margin, almost as wide at apex as at its widest point, apex about equal to width of r-m crossvein; portion of vein M_{1+2} from the crossvein to the r-m crossvein equal in length to the r-m crossvein **ramaleyi** (James)
Apical cell noticeably narrowed, apex scarcely half its greatest width and less than width of r-m crossvein; that portion of M_{1+2} from m to r-m much longer than r-m 9
9. Wing veins of male hyaline, ninth tergum without a pair of ventral lobes; cleft of tergum 'V' shaped 10
Wing veins brown; plates of ninth tergum each with a pair of strong median lobes; cleft of tergum narrowly U shaped **kuiterti** n. sp.
10. Plates of the ninth tergum of male as long on ventral margins as on dorsal **beameri** n. sp.
Tergum strongly developed on upper portion, length of dorsal margin twice that of the ventral **mirabilis** (Adams)

***Omphrale beameri* n. sp.**

(fig. 6a)

This species fits very closely the description given for *O. mirabilis* (Adams), the male genital structures, however, are very different. It is distinguished by the strong development of the ventral portion of the ninth tergum. The halteres are white to yellowish in the typical form.

Male genitalia: Ninth tergum broad, divided into a pair of lateral plates which fold around the genital structures. The cleft on the ventral portion is 'V' shaped, the posterior margins of the plate are simple, not lobate. Cerci two times as long as greatest width. The clasping structures are almost median in position and extend vertically (fig. 6a). Aedeagus rather simple, with two small, scarcely visible lateral prongs.

Length: body, 2.3-2.5 mm.; wing, 2-2.3 mm.

Female: Not separable from *O. mirabilis*.

Holotype, male, Olancho, Calif., Aug. 25, 1940 (R. H. Beamer). Allotype, female and twenty-seven paratypes, twenty males, seven females from following localities: same locality and data as holotype (R. H. Beamer, D. E. Hardy, E. E. Kenaga); Bishop, Calif., July 28, 1940 (R. H. Beamer); Lone Pine, Calif., July 28, 1940 (R. H. Beamer); Pinedale, Calif., July 22, 1940 (D. E. Hardy) and Fallon, Nevada, Aug. 12, 1940 (R. H. Beamer). All in Snow Entomological Collections.

***Omphrale beameri fusca* n. var.**

This apparently differs from typical *beameri* only by having the halteres chiefly brownish or black, only obscurely whitened.

This western form has been previously determined as *O. nubilipes* (Say) but until that species has been recognized it is perhaps better to consider them distinct.

Holotype male, Onyx, Calif., July 23, 1940 (R. H. Beamer). Allotype female and twenty-three, paratypes, twelve males, thirteen females from following: same data as type (R. H. Beamer, D. E. Hardy); San Jacinto Mts., Calif., July 21, 1929 (L. D. Anderson); Antioch, Calif., July 20, 1935 (R. H. Beamer); Seeley, Calif., July 17, 1940 (R. H. Beamer); Kernville, Calif., July 24, 1940 (R. H. Beamer); Ione, Calif., Aug. 9, 1940 (R. H. Beamer); Laguna Mts., Calif., July 6, 1929 (R. H. Beamer); Lone Pine, Calif., July 28, 1940 (R. H. Beamer) and Dixie, Ore., July 8, 1931 (R. H. Beamer).

All in Snow Entomological Collections.

***Omphrale cavifrons* Kröber**

***Omphrale cavifrons* Kröber, 1937, Stett. Ento. Zeit., 95, 231.**

This species appears very close to *O. fenestralis* (Linn.) apparently differing only by having a median depression on the lower part of the front; it is also slightly smaller in size. The writer would question its validity, in a large series of female specimens of *O. fenestralis* individuals have been observed with the lower portion of front flat to slightly depressed. Kröber allies this species with *senilis* (F.) and states that it is possibly just a variety of this.

Length: body, 4.1 mm.; wing, 3.7 mm.

Described from one female, Joinville, Algonquin.

Type in Hamburg.

***Omphrale electa* (Adams)**

(figs. 7a, b)

***Scenopinus electa* Adams, 1904, Kans. Univ. Sci. Bull., 445-446.**

This species is recognized by its elongate third antennal segment (fig. 7a), this is four times as long as wide, it is nearly three times as long as first two combined; the entire antenna is about equal in length to the head width. Chiefly black species, except for a yellowish brown spot on each side of the lower face, brownish yellow antennae and palpi, white knobs of halteres. white hind margins of abdominal segments three to five and yellowish tibiae and tarsi; the humeri, posterior calli and pteropleurae are also faintly yellowed. The mouthparts are well developed, filling most of the facial depression and the palpi are flattened apically and extend to about apex of labellum. The apical cell is strongly narrowed, the apex being much less than the length of r-m crossvein. Vein R_5 about three fourths the length of the R_{4+5} section. That portion of vein M_{1+2} between the m crossvein and the r-m is twice as long as the r-m. **Male genitalia:** Ninth tergum divided into two broad plates, these extend all of the way around the genital structures and serve as a protective covering; the ventral portion of each lateral plate is developed into a rounded lobe at apex (fig. 7b). Clasping structures simple, the coxopodite and claspers are almost completely hidden by the folding around of the tergum. Cerci about three times as long as wide, rounded at apices.

Length: 2.5 mm.

Type locality, Bill Williams Fork, Arizona.

Type in Snow Entomological Collections.

***Omphrale fenestralis* (Linnaeus)**

***Musca fenestralis* Linnaeus, 1845, Fauna Suec.**

This common species is almost world wide in distribution. It is readily recognized by its relatively large size, reddish legs, rugulose front and very narrowly separated eyes of the male. Chiefly black species, front of female with a distinct longitudinal median furrow, front of female much wider than ocellar triangle. Occiput rather swollen on upper portion, extending slightly higher than the eye margin. Antennae brownish black, third segment slightly more than three times longer than wide, with a subapical depression on outside margin. Mouthparts well developed filling most of the facial depression; palpi flattened on outer portions, distinctly haired, extending almost to tip of labellum. Dorsum of thorax finely rugulose, thickly covered with short recumbent pile. Margins of humeri, posterior calli and portions of pteropleurae yellowish. Knobs of halteres brownish above, white below. **Legs:** yellowish-red, tarsi brownish. Apical cell of wings widely open, the apex almost equal to width of r-m crossvein. Vein R_5 much longer than that portion of R_{1+2} from r-m crossvein to the fork. That portion of M_{1+2} between r-m and m crossveins equal to twice the length of the r-m. **Abdomen:** brownish black.

Length, 4.0-6.0 mm.

Described from Europe.

Type probably lost.

This species is very common, usually being taken upon the inside of windows. The larvae are predaceous upon capret beetles.

***Omphrale (Paraomphrale) glabrifrons* (Meigen)**

***Scenopinus glabrifrons* Meigen, 1824, Syst. Besch., 4, 114.**

This species has been used by Kröber⁴ as the genotype of a proposed new genus, ***Paraomphrale***. This was separated from ***Omphrale*** by having the eyes of the male distinctly separated on the front, front almost equal to the width of the median ocellus and by having the front smooth and polished. This writer prefers to treat this as a subgenus, the above characters alone appear somewhat variable and do not seem to represent good generic differences.

The species is very similar to ***O. fenestralis***, it is readily distinguished by the smooth and polished front, entirely white halteres and slightly smaller size.

Length: 4.0-5.0 mm.

Described from Europe.

Type probably lost.

⁴ 1937, Stett. Ento. Zeit., 98, 222.

This species is very widely distributed; it has been recorded from many localities in America, Europe, North Africa and Australia.

Omphrale kuiterti n. sp.

(fig. 8a)

This species is related to *O. mirabilis* (Adams). It is readily distinguished by the strongly developed median lobes of the male ninth tergum, the brown wing veins, narrower apical cell and slightly larger size.

Male.—Almost entirely black species. **Head:** Facets of lower one-third of compound eyes very small compared to those of upper two-thirds. Eyes very narrowly separated on the front, much less than the width of the median ocellus; front polished and smooth in median portion below, finely rugulose and sub-shining above and along eye margins. Sides of face chiefly vertical, only a very narrow rim next to the eye margins. Mouthparts well developed, filling most of the facial depression. Palpi broad and flat, extending nearly to apex of labellum. Occiput concave, very poorly developed. Lower portion of face with fine white pile. Third segments of antennae three times as long as greatest width, with a subapical depression on outside; brownish black in color, with microscopic gray pubescence. **Thorax:** Shining black in ground color, finely rugulose, mesonotum and scutellum somewhat grayed due to the moderately thick covering of short recumbent white pile. Humeri with a faint brownish spot on hind portion. Margins of posterior calli yellowish. Stems of halteres brown, knobs white. Thorax scarcely longer than high. **Legs:** Apices of femora and first two to three subsegments of tarsi yellowish, otherwise dark brown to black. All hairs white. Basitarsi slightly longer than next three subsegments. **Wings:** Costa ending just before apex, apical cell very narrowly open, the apex is equal to about one-fifth the greatest width of the cell. The free portion of R_2 is about three-fourths the length of that section of R_{1+2} between the r-m crossvein and the fork. Crossvein r-m situated at apical two-thirds of discal cell. **Abdomen:** Shining, chiefly brownish to black, the terga of segments three to five strongly narrowed, exposing the white conjunctiva. **Genitalia:** Ninth tergum well developed and extending around the genital structures; much longer, not so broad as in related species. The ventral portions which extend over the coxopodite are developed into a long slender lobe at each of their apices (fig. 8a). The tergum is scarcely divided into two plates on the ventral surface, with a narrowly U shaped cleft between these. Cerci about two times longer than wide. Coxopodite wider than long, divided into a pair of short lobes apically, these with a U shaped cleft between. Aedeagus two branched, these are long slender and very conspicuous. Claspings structures simple, strongly curved inward.

Length: body, 3.0 mm.; wing, 2.4 mm.

Female unknown.

Holotype male, Buckeye, Arizona, July 16, 1940 (L. C. Kuitert). One

paratype male, Black Mountain, Arizona, July 13, 1932 (R. H. Beamer). Both in Snow Entomological Collections.

The writer takes pleasure in naming this species after Mr. L. C. Kuitert.

***Omphrale mirabilis* (Adams)**

(fig. 9a)

***Scenopinus mirabilis* Adams, 1904, Kans. Univ. Sci. Bull., 2, 445.**

This small species is best distinguished by its chiefly black color, white knobs of halteres, pale wing veins of the male and the strongly produced ninth tergum. It has been known only from the type female, the association of the male is not at all certain. The specimens described below appear to be conspecific with the holotype.

Male.—Head: Eyes very narrowly separated on the front. Front shining, finely rugulose on the sides and with a faint longitudinal median furrow. Facets of lower third of compound eyes very small compared to the upper two-thirds. Antennae brownish black, third segment about three times longer than wide, situated well below middle of the eyes. Mouthparts filling most of facial depression, palpi hairy and slender, slightly flattened toward apices. Lower portion of face and occiput sparsely haired. Occiput weak, somewhat concave on upper portion. **Thorax:** Shining black in ground color, finely rugulose. Mesonotum and scutellum faintly pollinose and with sparse, white pubescent pile. **Legs:** Almost entirely black, tarsi yellowish. Basitarsi equal to next three subsegments in length. **Wings:** Hyaline, veins very slightly yellowed, chiefly concolorous with the membrane. Costa ends at about the wing apex. Crossvein r-m situated at apical two-thirds of discal cell. Apical cell is not so noticeably narrowed as in *O. kuiterti*, the apex being slightly shorter than or about equal to the r-m crossvein. Vein R_{4+5} about two-thirds the length of the portion of R_{4+5} between r-m and the furcation. That portion of M_{1+2} between the r-m and m crossvein about twice as long as r-m. **Abdomen:** Chiefly polished black, covered with fine pale pile. Terga of segments three to five very narrow revealing the pure white conjunctiva. **Genitalia:** Ninth tergum folded around the genitalia and rather strongly developed on the upper portion; the length of the upper edge of each plate (that which extends over the coxopodite) is twice that of the lower edge (that extending above anal region). The posterior elongations of each plate are broad, somewhat rounding at their apices and have a distinct notch near outer edges (fig. 9a). The cerci are broad and rather short, not much longer than greatest width. The coxopodite is as wide as long, the posterior margin is tapered into a slender median lobe, this has a V shaped cleft at its apex. Clasping structures thick, curved inward. Aedeagus divided into three short prongs at apex.

Length: Body, 2.3-2.5 mm.; wings, 2-2.3 mm.

Female.—Of larger size; front much wider than ocellar triangle, finely rugulose and with a distinct longitudinal furrow. Abdomen entirely brownish black.

Length: Body, 3.4-4 mm.; wings, 2.5 mm.

Type locality, Bill Williams Fork, Arizona.

Type in Snow Entomological Collections.

The writer has identified this species from the following localities: Baboquivari Mts., Arizona, July 24, 1941 (L. H. Banker); Turkey Creek, Arizona, June 10, 1933 (R. H. Beamer); Milagro, New Mexico and Las Cruces, N. M., July 3, 1940 (R. H. Beamer).

The specimens from Alamogordo, New Mexico, described by Cresson⁵ as *Scenopinus nubilipes* Say possibly belong here.

Omphrale nubilipes (Say)

Scenopinus nubilipes Say, 1828, Jour. Phil. Acad. Sci., 6, 170.

This species is recognized by its brownish to black halteres, small size and chiefly black body and appendages. In general it resembles *O. mirabilis* (Adams).

This species is not clearly differentiated and until the male genitalia of specimens from near the type locality can be studied its determination is questionable. It is supposed to be characterized by having black halteres and brown wing veins, there are other species concerned which have varying amounts of brown to black on the halteres.

Length: 2.0-4.0 mm.

Type locality, Indiana.

Type probably lost.

The writer has not seen this species although it was formerly considered one of the most common members of the family. Probably most of the western records that are in the literature should actually pertain to some other species.

Omphrale ramaleyi (James)

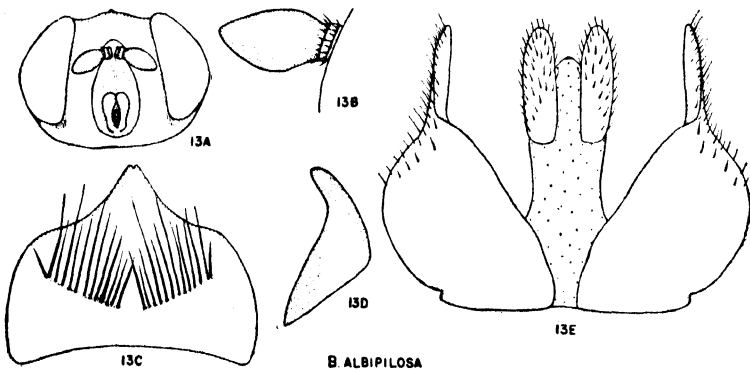
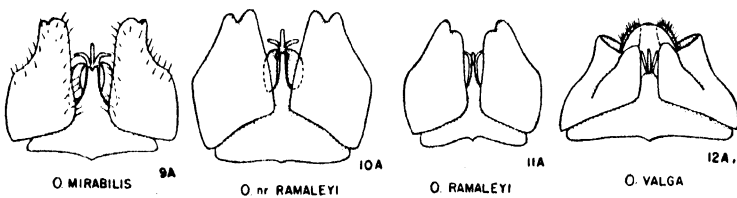
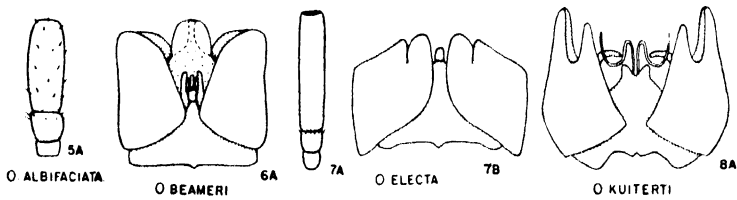
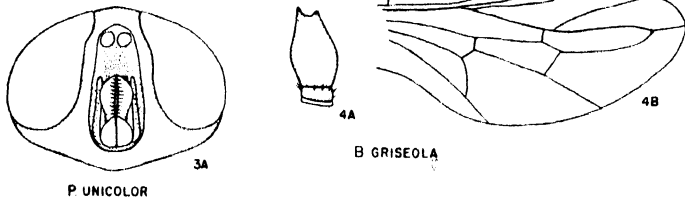
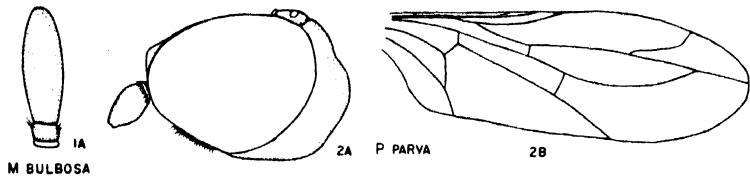
(fig. 11a.)

Scenopinus ramaleyi James, 1938, Jour. Kans. Ent. Soc., 11, 22-23.

⁵ 1907, Trans. Am. Ent. Soc., 33, 111.

EXPLANATION OF PLATE

- Fig. 1. *Metatrichia bulbosa* Osten Sacken, a. antenna.
- Fig. 2. *Pseudatrichia parva* n. sp., a. head, lateral; b. wing.
- Fig. 3. *P. unicolor* Coquillett, a. head, facial view.
- Fig. 4. *Brevitrichia griseola* (Coquillett), a. antenna; b. wing.
- Fig. 5. *Omphralosoma albifasciata* n. sp., a. antenna.
- Fig. 6. *Omphrale beameri* n. sp., a. male genitalia, dorsal.
- Fig. 7. *O. electa* (Adams), a. antenna; b. male genitalia, dorsal.
- Fig. 8. *O. kuiterti* n. sp., a. male genitalia, dorsal.
- Fig. 9. *O. mirabilis* (Adams), a. male genitalia, dorsal.
- Fig. 10. *O. nr. ramaleyi* n. sp., a. male genitalia, dorsal.
- Fig. 11. *O. ramaleyi* (James), a. male genitalia, dorsal.
- Fig. 12. *O. valga* n. sp., a. male genitalia, dorsal.
- Fig. 13. *Belosta albipilosa* n. sp., a. head, facial view; b. antenna; c. coxopodite of male; d. left clasper of male; e. ninth tergum, cerci and anal region of male.



This species is very close to that interpreted by this writer as *O. mirabilis* (Adams). It is distinguished by having the apical cell more broad, scarcely narrowed, the veins of wings brownish. The plates of ninth tergum of male each have a distinct notch near apex of dorsal margin (fig. 11a) (those margins which fold over coxopodite) but these lobes are of about equal size instead of the inner lobes being many times larger than the outer as in *mirabilis*. The posterior median lobe of the coxopodite is very slender, scarcely wider than the median prong of aedeagus. The clasping structures are more strongly curved than in *mirabilis* and the cerci are nearly twice as long as wide. In other respects the specimen at hand fits the description of *mirabilis*.

Length: 2.0 mm.

Female.—The front broad and finely rugulose, abdomen wholly shining black and knobs of halteres with a considerable amount of brown on them. Slightly larger than the male.

Length: 2.5 mm.

A male specimen is on hand from Lusk, Wyoming, July 14, 1937 (C. L. Johnson) which fits *ramaleyi* except that the plates of ninth tergum of the male are divided into two small apical lobes (on dorsal surface) by a median concavity (fig. 10a).

Type locality, Roggen, Colorado.

Type in collection at Colorado State Agriculture College.

The writer has specimens from Masonville, Colorado, July 12, 1937 (C. L. Johnson).

Omphrale valga n. sp.

(fig. 12a)

This species is related to *O. nubilipes* (Say) and to *beameri* n. sp. It is distinguished by having the abdominal terga three to five broad, revealing just a narrow white band of conjunctiva; the terga are three to four times wider than the white bands. The plates of ninth tergum differ by having a distinct lateral swelling and a short posterior lobe on dorsal portions.

In most respects this fits the description of *O. mirabilis* (Adams), the frontal groove is distinct and shining and the median portion of the front has a slightly depressed area at about one-third the distance from antennae to ocelli. The narrowed portion of the front is not much longer than the ocellar triangle. Almost entirely black species, usually only tarsi and spots at back of humeri and posterior calli yellow. Halteres brownish to black. The wings are faintly brownish tinged and the veins are brown. Venation as in *mirabilis* except that vein R_1 is scarcely longer than R_2 . Abdomen, as stated above, is characterized by having all terga broad with but little conjunctiva showing. **Male genitalia:** The plates of ninth tergum fold around the genital structures, dorsal margins lobate on posterior portion (fig. 12a), clasping structures simple, curved inward. Aedeagus three pronged, the middle portion is curved dorsally. Cerci about two times as long as wide.

Length: body, 2.6 mm.; wings, 2.1 mm.

Holotype, male, Yosemite National Park, California, August 1, 1940 (R. H. Beamer); one paratype, male, same data as holotype and one paratype, male, from Big Bear Lake, Calif., July 26, 1932 (R. H. Beamer).

Types in Snow Entomological Collections.

THE LESSER CORNSTALK BORER, A PEST OF FALL BEANS¹

DWIGHT ISELY AND FLOYD D. MINER²

Department of Entomology, University of Arkansas

The lesser cornstalk borer³ caused an unusual and a serious loss of stand in the fall bean crop in northwestern Arkansas during August, 1943. The loss of stand occurred during the seedling stage and frequently exceeded 50 per cent, and fields in which less than 20 per cent of the stand was destroyed were exceptional. Larvae of this borer were also present in all fields of early beans, corn, and sorghum, wherever observations were made. In this paper the character and extent of injury, the factors associated with it in the field, and possible prevention are discussed. The most satisfactory description of the stages, life history, and seasonal history of the lesser cornstalk borer are given by Luginbill and Ainslee. (3).

The lesser cornstalk borer has been recognized in Arkansas during the past 20 years as an occasional local pest of its various hosts, particularly of corn, beans, and cowpeas. The injury which was observed, however, has never appeared to be extensive. Usually it involved injury to stand in spots covering a few square rods. In an extreme instance the stand of nearly an acre of corn planted in June was practically destroyed. Similarly, only injury of local importance has been recorded by previous observers, including Riley (4), Chittenden (2), and Luginbill and Ainslee (3). By the latter the destruction of stand covering as much as two acres was given special notice.

In contrast to previous records, the current outbreak was both general and severe. Throughout the commercial bean growing area, consisting of 11 counties in the northwestern part of the state extending from the Arkansas River Valley on the south to the Missouri line on the north, the borer was consistently injurious. The stand of all fields of fall beans observed was reduced, except for a few restricted spots which will be discussed later. Infestations were also found in other parts of the state. In addition to the fall bean injury, the borer was invariably found in fields of early beans and of corn, although injury was not obvious.

¹ Research paper no. 783. Journal series, University of Arkansas.

² The writers are indebted to E. L. Gilliland, instructor in vocational agriculture at Rogers, Arkansas, for a part of the field records.

³ *Elasmopalpus lignosellus* (Zeller); order Lepidoptera, family Phycitidae. Determined by Carl Heinrich, U.S. Bureau of Entomology and Plant Quarantine.

The average reduction of stand in fields of fall beans was not less than 30 per cent. As an illustration of extreme injury, in one field of 18 acres which was visited about 10 days after the bean plants had emerged from the soil, 80 per cent of the plants had been killed. As already stated, fields in which the injury was less than 20 per cent were rare. If a loss of 30 per cent of the stand is taken as average, the loss in a single county, in which the damage was typical and for which estimates of the acreage planted in fall beans is available, would be not less than 1,200 acres. The total reduction of stand of fall beans in the state must have amounted to several thousand acres. This estimate takes no account of the less obvious damage to other crops where the stand was not injured but where some reduction in yield must have occurred.

HOSTS

The lesser cornstalk borer feeds upon a wide range of plants. Most of the hosts which have been recorded are grasses or legumes. Since it has also been found attacking plants as distantly related to these groups as turnips and strawberries, it is likely that its range of hosts is only partly known. The hosts recorded by Luginbill and Ainslee (3) include beans, cowpeas, peanuts, corn, crab grass, chufa, Japanese cane, sugar cane, sorghum, milo, Johnson grass, wheat, and turnips. Observations in Arkansas would add to the list foxtail, barnyard grass, and strawberries. No attempt has been made to determine the limits of the plant species attacked. Crab grass was the most important weed host, in part because of its general distribution and abundance.

The plants listed as hosts are not necessarily equally favorable to the lesser cornstalk borer. As for instance, in limited life history studies it was found that the survival of newly hatched larvae placed on seedling corn was much higher than that of larvae placed on beans. Furthermore, the time required for completion of larval development on corn was about three-fourths as long as that on beans. When both host plants were available, corn was preferred.

CHARACTER OF INJURY

The young bean plants were particularly susceptible to injury during the first two weeks after emergence from the soil. The stems of these plants were attacked by the larva most often below the soil surface. The larva fed within the stem and when the inner tissue of the plant was nearly destroyed, emerged either above or below the surface of the soil. A plant so injured wilted within a day and the larva migrated to another plant. Migrating larvae were observed moving from plant to plant, even during the heat of the day. Thus a single larva was capable of destroying a number of seedling bean plants.

Bean plants 60 days old or more could support several larvae without being noticeably injured. Usually the larvae did not feed within the woody stem of an older plant but upon the green tissues around the underground stem, although at times they were found within the stem itself. In fields

of beans old enough to set fruit and of well grown corn, the number of larvae to a square yard was frequently much greater than in fields of late beans, but since the older plants were less susceptible to injury, they were not destroyed and the infestation was not obvious.

The injured rows or spots were conspicuously marked in fields of young beans by the rows of wilted plants. At the underground point of entry, a long silken tube covered with particles of soil was frequently found. This tube, which is characteristic of many of the sod webworms, might be used as an additional identification character. The larvae found in the beans were frequently so large that it was apparent that they were older than the bean plants themselves, indicating that they had begun their development on another host. Larvae of the lesser cornstalk borer were also collected on the underground stems of grasses within the bean fields. The most common of these grasses were crab grass, foxtail, barnyard grass, and Johnson grass. The most frequent injury to corn, as it appeared on full grown plants in August, was characterized by burrows within the roots which form the circle nearest the surface of the soil and sometimes within the brace roots. Larvae were also found feeding on the green part of the cortex of stalks behind the leaf sheaths at the lower nodes. The injury to peanuts was to both underground stems and developing nuts.

The destructiveness of the lesser cornstalk borer in 1943 could not have occurred in such unusual proportions had there not been great increase in acreage of a host which was in a stage of development susceptible to injury at the same time that borers were present in large numbers. The abundance of borers at this time had been favored by a heavy rainfall during May and June which, coupled with a shortage of labor, resulted in a widespread infestation of fields with crab grass. During this season, crab grass was the most important weed host. Some such injury may have occurred during previous years and have been overlooked. In 1943 before the larvae were found in the bean stalks, growers frequently attributed the loss of stand to drought or to fertilizer injury. Nevertheless, the outbreak in 1943 was unique in extent and severity since any approach to it could not have escaped attention.

The bean acreage in Arkansas has increased several fold during the past few years. The average commercial acreage for the 10-year period prior to 1943 has been estimated at 3,450 acres (Bryan et al). While a complete estimate for the acreage in 1943 is not available, the expected acreage was more than 10 times greater than the average for the 10-year period. For example, in a single county, Benton,⁴ for which estimates are available, the beans which were planted in 1943 totaled 7,000 acres, of which 4,000 acres were fall beans. In 1938 the commercial crop in the same county was from 1,000 to 1,500 acres.

All of the infested fields had certain characteristics in common. Most of them had produced a spring crop of beans. In all of the infested fields there

⁴ Estimates by P. R. Corley, County Agent, Benton County.

had been a heavy growth of crab grass and some other wild grasses. Some of the fields had been plowed and disked only a few days before planting. Others had been prepared a few weeks before. However, in none of the infested fields which were observed had the preparation been thorough enough to destroy all grass, for clumps of grass were found in all fields with webs of the borers attached to the stems. It appeared that a partial destruction of the hosts had been just enough to have hastened a migration to the new crop. Roughly there appeared to be a direct relationship between the amount of crop and weed residue in a field and the severity of borer infestation.

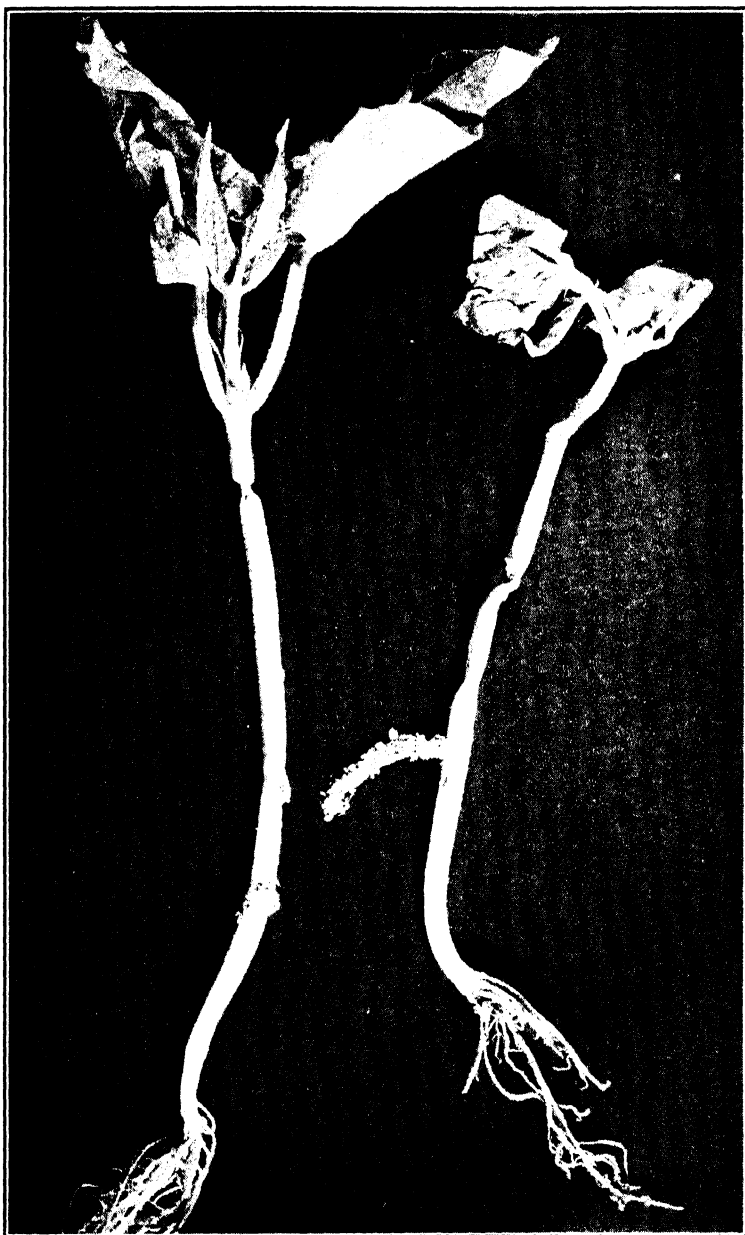
The source of infestation was also shown by a study of the uninfested crops. In the uplands only one uninfested field was found. It was within 600 yards of another field in which the stand had been practically destroyed. In the uninfested field there was no obvious crop residue two weeks after planting. The land had been in lespedeza in 1942, and had produced a spring crop of beans. The field was on well drained upland and the owner had been fortunate in being able to cultivate early enough to destroy any start of wild grasses that might have appeared in his first crop. The field had been thoroughly prepared about three weeks before planting. In another upland field in which the infestation was relatively light, that is only about 15 per cent of the stand destroyed, most of the heavy growth of crab grass which had infested the early crop was removed at the time the land was prepared for replanting.

A large acreage of beans was planted late in August in Crawford County in the Arkansas River bottoms on land that had been subjected to overflow during the flood in May which covered thousands of acres of farm land. The flood destroyed all the early crops and weeds, and had the effect of complete clean cultivation. After the water had receded and the land had dried, it had been given clean cultivation prior to planting to beans. These fields in the flooded area make up the restricted territory, previously referred to, in which no infestation was found. In contrast, stands of beans grown on land nearby, which had not been subjected to flooding but which had been infested with grass, were seriously injured.

The season was one which might have been expected to be favorable to the lesser cornstalk borer. During May rainfall occurred on 17 days at Fayetteville and exceeded a total of 15 inches. The excessive rainfall, together with a shortage of labor, interfered with clean cultivation of crops and resulted in a much heavier growth of crab grass than is usual. During July and August drought and heat were excessive. High temperature according to Luginbill and Ainslee is favorable to the insect. In any case it caused injured plants to wilt more quickly and make the injury more obvious.

PREVENTION OF INJURY

The observations indicate that complete destruction or removal of all living plant residue in fields some weeks before planting a late bean crop



Seedling bean plants showing injury with larval tube attached to stem at point of entrance. (Photo by Weldon Larimore, student assistant, Department of Entomology).

would prevent an outbreak such as the one described. In such fields partly grown larvae that had begun their development on other hosts would not be present at the time seedling bean plants emerged from the soil. Larvae hatching from eggs deposited in a field after plants were up could not have caused such severe injury since, during the period which is necessary for incubation and for the larvae to attain a destructive size, the most susceptible stage of the beans would have passed. This method of control has the weakness of depending upon complete destruction of all intermediate hosts before planting. The requirement of thoroughness was shown in infested fields which had been prepared for planting three or four weeks before harvest and in which, nevertheless, enough plants survived the cultural practices employed to maintain an infestation of borers. Shortage of labor, conflict with other farm operations, or unfavorable weather may frequently interfere with thoroughness unless the farmer is impressed with the importance of this operation. Since the pest appears to be erratic in occurrence, inspection of the underground stems of its hosts present in a field before planting may be a guide for procedure.

The recommendation of Luginbill and Ainslee for the destruction of all stages occurring in plant residue during winter no doubt will prevent or reduce the severity of early infestations, and thus indirectly protect late crops. Since, however, there are several generations a year, it is possible for the pest to occur in large numbers by midsummer even though the first generation has been very small. For this reason, additional control measures for late crops may be necessary.

Control with an insecticidal dust was given trial since the borers migrated from plant to plant. Cryolite, barium fluosilicate, and calcium arsenate were used by applying the dust to the stems and under sides of the foliage. No satisfactory results were secured. It is probable that many of the plants in all plots were infested at the time dust applications were made.

SUMMARY

The lesser cornstalk borer, ordinarily considered a minor or a local pest, destroyed several thousand acres of fall beans in the seedling stage in northwestern Arkansas in August, 1943. In addition, an infestation occurred on practically all of its other hosts in this area. Apparently most of the injury to seedling beans was caused by partly grown larvae which had developed in the fields either on previous crops or on weed grasses in these fields. Complete destruction of these hosts three or four weeks before planting is the most obvious means of preventing such injury. Observations in fields prior to planting beans, to determine the presence or absence of a destructive infestation, would be of value in determining the need of preventive measures.

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NEW MUSCOID DIPTERA FROM THE UNITED STATES¹

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Most of the new forms described below were encountered in a study of some recent additions of Tachinidae to the Snow Entomological Collections at the University of Kansas. The specimens were collected, in large part, during the course of various expeditions to southeastern and western states under the direction of Dr. R. H. Beamer, to whom I am indebted for the privilege of studying the material. Some additional material in my collection, representing identical or related new forms, has been included. Types of the new species, unless otherwise indicated under the descriptions, are deposited in the Kansas University Museum.

Eumacronychia duplicata, n. sp.

Similar to *E. prolixa*, but smaller and not so elongate in build. There are also distinct differences in the genitalia.

Male.—Front at antennal base about equal eye width, widening slightly toward vertex; parafrontals pale pollinose, face and cheeks concolorous but more silvery; frontal vitta pale orange yellow, gradually widened toward vertex, at middle nearly twice parafrontal width; verticals two pairs, outer about half as long as inner; ocellars proclinate and strongly divaricate; frontals rather weak, set close to lateral margin of frontal vitta and stopping at antennal base; two proclinate and one reclinate orbital bristles; antennae nearly as long as face, wholly orange yellow, third segment not quite three times longer than second; arista slightly darker than antennae, bare, thickened about to middle, proximal segments short; face rather deeply excavated, its ridges bare, hardly diverging downward; vibrissae near oral margin, not approximated; parafacial wider than clypeus, sparsely clothed with very minute or inconspicuous pale hairs; palpi yellow, subequal length of haustellum and slightly thickened near tips; proboscis short; cheek with black hairs on lower border, nearly one-third eye height; eyes bare, slightly oblique and nearly reaching vibrissal level; back of head sparsely clothed with short black hairs.

Thorax including scutellum black, with heavy pale grayish pollen, notum vaguely vittate; acrostichal bristles absent or hairlike, dorsocentrals 2 before suture and 3 behind; pteropleural vestigial; sternopleurals 2; scu-

¹ Contribution No. 837, Division of Entomology, Texas Agricultural Experiment Station.

tellum with 2 good-sized lateral and a small decussate apical pair, no discals; prosternum and propleura bare; calypters opaque white; infrascutellum not developed.

Abdomen elongate tapering apically, black except anal segment which is wholly orange yellow, silvery pollen bands sharply defined on basal three-fifths of segments two and three but on less than basal half on anal; second segment with one pair of median marginals, third and fourth each with marginal row; genital segments orange yellow, rather large and prominent; inner forceps elongate, triangular as viewed from behind, united nearly to middle thence divided into two slender blackish prongs tapering to acute tips; outer forceps hardly heavier or shorter than inner pair, curved outward near base thence strongly inward to tip, latter blunt with a minute tooth on anterior extremity; penis short, basal segment supported by a chitinized rod from near apex of which arises a backwardly directed short tubular segment membranous in structure; fifth sternite with a broad and deep U-shaped median incision, lobes not prominent, inner apical margin evenly rounded, clothed with fine black hairs.

Legs black; hind tibia with two or three unequal bristles on outer posterior side and mid tibia with one smallish bristle on outer front side near middle; claws and pulvilli elongate.

Wings hyaline; first posterior cell narrowly open far before wing tip; third vein setulose halfway or more to small cross vein; last section of fifth vein about two-fifths length of preceding; costal spine slender, shorter than small cross vein.

Female.—Front at antennal base about equal eye width; arista dark brown, palpi distinctly thickened apically; third antennal segment about two and one-half times length of second; abdomen shorter and broader than in male, pollen bands occupying basal two-thirds of last three segments; first genital segment slightly arched at middle above; claws and pulvilli short.

Length, 5.5-7 mm.

Holotype male and allotype female, Albuquerque, New Mexico, July 1 and 5, 1941 (R.H. Beamer). Paratypes; 3 males, same data as type.

Sciasma lustrans, n. sp.

Body wholly shining black, legs orange red tibiae blackish; wings infuscated costally to apex of discal cell thence whitish to tip; third vein evanescent near wing tip.

Male.—Front very much narrowed at middle thence diverging upwards to width of ocellar triangle; frontal vitta black, reduced to a line above middle; parafrontal very narrow, shiny black but with a whitish bloom apparent on lower part; frontals short, stopping at triangle, one or two bristles beneath antennal base; inner verticals straight; ocellars reduced to small stubby proclinate hairs; face rather deeply impressed, its ridges oblique, bearing a few hairs next to vibrissae, which are on oral margin; epistoma short, hardly narrowed from clypeus and only slightly bowed forward from

same; parafacial sublinear, bare, blackish; antennae wholly yellow, third segment hardly one and one-half times longer than second and reaching nearly to oral margin; arista bare, very slender or bristlelike, middle segment thickened but short; eye bare, large, occupying most of head in profile and reaching below vibrissal level; cheek very narrow, subshiny black; proboscis short, palpi yellow, tips moderately thickened; back of head shining black, much flattened above middle, sparsely black-haired.

Thorax and scutellum black, destitute of pollen and weakly bristled; two postsutural dorsocentrals and sternopleurals; pteropleural minute; scutellum with two good-sized laterals, hindmost near apex and decussate; infrascutellum normally developed; calypters transparent brown, hind lobe longer than wide; prosternum bare; propleura bristled on front margin.

Abdomen long ovate, first segment longer than any following, last two each with a marginal row of microchaetae; hypopygium large, curved forward beneath tip of abdomen, sternites covered.

Legs rather weakly bristled, femora considerable thickened; hind tibiae not ciliated; claws and pulvilli hardly half as long as apical tarsal segment.

Wings long and narrow, brownish on costal margin to apex of second vein thence whitish hyaline to tip; first posterior cell narrow, closed, petiole nearly twice length of apical cross vein and reaching costa at exact wing tip; hind cross vein straight, distinctly nearer small cross vein than bend; latter rounded rectangular, without stump or fold; costal spine vestigial.

Length, 3.5-4 mm.

Holotype: male, Mt. Diabolo, Calif., July 16, 1933 (R. H. Beamer). Paratype: 1 male, Cajon Pass, Calif., August 6, 1936 (R. H. Beamer).

***Plagiomima haustellata*, n. sp.**

Allied to *P. anomala*, but at once distinguished by the longer proboscis and subfasciate abdomen.

Male.—Front at vertex 0.48 of head width, diverging slightly downward; pollen of head grayish on parafrontals, subsilvery on parafacials and cheeks; latter bare, reddish in ground color, nearly one-half eye height; parafacials setose except on outer margin, nearly equal clypeal width; facial ridges bare; lowermost frontals upturned, well below base of antennae; ocellars large, curved outward and but slightly forward; two pairs of strong verticals and proclinate orbitals; antennae reaching nearly to epistoma, proximal segments reddish yellow, third black and about twice length of second; arista shorter than third antennal segment, thickened on over basal half, tapering to sharp tip; proboscis extra long, extending almost to mid venter, (the haustellum is laterally compressed in all available specimens, so that it appears unusually thick in profile), labella small; palpi yellow, slender, about two-thirds length of third antennal segment; back of head moderately bulged, clothed with short pale hairs.

Thorax and scutellum black, gray pollinose; notum marked with four rather shiny black vittae; acrostichal 3, 3; dorsocentral 3, 3; humeral 3-4; posthumeral 2; presutural 2; intraalar 3; supraalar 3 (middle one very

large); postalar 2 (hindmost very large); sternopleural 2, 1; pteropleural 1 (small); scutellum with 2 lateral (hindmost very large) and 1 strong decussate apical besides a small preapical and discal pair; prosternum, propleura and sides of postnotum beneath calypters bare.

Abdomen long ovate, black in ground color, with gray pollen in evident cross bands on basal two-thirds of segments two to four, remainder of each shining black; second segment with one pair of median marginals, last two each with marginal row; genital segments moderately large, black; inner forceps reddish, united and slender to tip; outer forceps subtriangular in profile with anterior edge straight, tips rather blunt; penis ribbonlike; fifth sternite black, deeply divided.

Legs moderately long, black with tibiae slightly reddish; middle pair of latter with row of five or six unequal-sized bristles on outer front side; claws and pulvilli slightly elongated but shorter than apical tarsal segment.

Wings hyaline; first, third and fifth veins setose in part; last section of fifth vein equal length of preceding section; hind cross vein oblique, nearly midway between small cross vein and bend of fourth; latter with long stump; first posterior cell open far before wing tip; costal spine vestigial.

Female.—Very similar to male, except for sexual differences.

Length, 9-11 mm.

Holotype male and allotype female, labeled "Anderson Co., Ks., 1047, 15 (R. H. Beamer)" Paratypes: 1 male and 2 females same data as type; 4 males, Allen Co., Ks., 1962, 15 (R. H. Beamer; 5 females, "Clark Co., Kan. 1950 ft., August 15-25, 1911 (F. X. Williams)"; 1 female, Elsinore, Utah, August 12, 1936 (M. B. Jackson).

Orthosia, n. gen.

Differs from *Microchaetina* in having the face much more deeply impressed and receding; epistoma short, not narrowed from clypeus; vibrissae on oral margin; hind crossvein less retracted, etc.

Male only.—Head a trifle wider than high, frontal profile slightly sloped, four-fifths length of receding concave facial; antennal axis well above eye middle and about two-fifths longer than vibrissal, latter considerably above lower edge of head; clypeus deeply sunk; epistoma wide, bowed sharply forward from clypeal plane; facial ridges bare, not strongly divergent downward; front at vertex over one-third of head width, gradually widened downward to antennae; frontal rows not or but weakly divergent anteriorly, one or two bristles below antennal base; inner verticals long, suberect; two proclinate orbitals; ocellars strong, proclinate and divergent; parafacial rather narrow, beset with short hairs and a median row of longer infraclinate bristles extending from arisal level to cheek groove; antennae as long as face, first segment short, third nearly five times longer than second; arista long pubescent or short-haired, thickened to middle, proximal segments short; eye bare, smallish, not reaching vibrissal level; cheek nearly three-fourths eye height; proboscis short, haustellum moderately slender; palpi small, subfiliform; back of head convex and somewhat bulged below middle.

Thoracic chaetotaxy: acrostichal 2, 3 (first two pairs behind suture small); dorsocentral 3, 3; intraalar 2; supraalar 3; presutural 1 (outer); posthumeral 1; humeral 3-4; notopleural 2; postalar 2; intrapostalar small; sternopleural 2, 1; pteropleural (small); scutellum with 2 lateral, 1 decussate apical (nearly as strong as hind lateral) and 1 small discal pair; prosternum, propleura and sides of postnotum beneath calypters bare; infrascutellum normal in size; hind lobe of calypter moderately large, roundish. Abdomen at base nearly as wide as thorax and rather strongly tapered toward apex; basal segment without median marginal bristles, second and third each with one stoutish pair set far forward from hind margin and a smaller discal pair on third segment (lacking in one specimen); anal segment with a discal and marginal row; sternites covered. Legs moderately long and slender; hind tibiae not ciliated; claws and pulvilli shorter than apical tarsal segment. Wings normal in size and shape; first vein bare; hind cross vein subperpendicular to fourth and joining latter about midway between bend and small cross vein; first posterior cell closed, petiole three-fourths length of apical cross vein and reaching costa far before wing tip; bend of fourth vein nearly rectangular bearing a short stump or fold; last section of fifth vein barely over one-half length of preceding; costal spine subequal length of small cross vein.

Genotype: *Orthosia montana*, n. sp.

Orthosia montana, n. sp.

Male.—Front at vertex 0.38 of head width (average of two specimens), widening to 0.50 of same at base of antennae; frontal vitta deep red, broader than usual and occupying most of frontal width at vertex; parafrontals and parafacials gray pollinose on blackish ground color; cheek grooves broadly red, this color extending upward to include vibrissal angles and lower inner margin of parafacials; basal segments of antennae red, third wholly black, rather slender but wider than parafacial; arista black, subequal length of third antennal segment; palpi yellow; back of head gray pollinose, sparsely clothed with black hairs intermixed with pale ones below.

Thorax black, gray pollinose, notum with four poorly defined dark vittae, outer ones interrupted at suture and inner pair obsolete shortly behind; scutellum black, tinged with red at apex, disk dusted with gray pollen; calypters tawny.

Abdomen black with changeable gray pollen above extending to hind margin on all segments, viewed at a flat rear angle the pollen shows a distinct brownish tinge; hypopygium blackish, retracted; forceps small; fifth sternite with a deep apical V-shaped incision, black lobes subshiny and sparsely haired.

Legs black, tibiae, trochanters and sometimes femora on lower edge before apex tinged with red or yellow; middle tibiae with one anterodorsal bristle; pulvilli nearly one-half length of last tarsal segment.

Wings gray hyaline, slightly infuscated along cross veins; stigmal section

of costa short; small cross vein opposite apex of first; epaulet and subepaulet red.

Length, 5 mm.

Holotype: male, Santa Cruz Mts., Calif., August 13, 1938 (R. I. Sailor).

Paratype 1 male, same data as type, collected by L. W. Hepner.

***Orthosia palaga*, n. sp.**

Female.—Similar to the preceding species except as follows: Front at vertex 0.41 of head width, gradually widening downward to antennal base; facial depression including inner margin of parafacial to antennal base red in ground color; antennae barely two-thirds length of face, proximal segments and base of third pale reddish, latter slender, three to four times second; arista thickened on basal third; parafacial over one-half clypeal width, sparsely short-haired with a median row of bristly hairs becoming stronger downward; face not strongly receding; clypeus moderately depressed; epistoma gently bowed forward; eye rather strongly oblique. Abdomen ovate, third segment with one pair of good-sized discs; genitalia not adapted for piercing. Legs red, tarsi blackish; claws and pulvilli short.

Length, 5 mm.

Holotype: female, Santa Cruz Mts., Calif., August 13, 1938 (L. W. Hepner). Paratype; 1 female, same data as type, taken by Dr. R. H. Beamer.

***Orestilla*, n. gen.**

Differs from *Microchaetina* in having wider and wholly bare parafacials; antennal axis well below eye middle; last section of fifth vein less than half as long as preceding; other differences are listed below.

Head as wide as high, frontal profile well sloped and distinctly longer than facial, latter hardly receding; antennal axis subequal length of oral; clypeus a little depressed, much narrower than parafacial; epistoma slightly elongated, gently bowed forward and considerably narrowed from clypeus; vibrissae well above oral margin; facial ridges bare, subparallel; frontal rows stopping near base of antennae; two proclinate orbitals in female and usually only one in male; latter without outer verticals; ocellars strong, proclinate; antennae reaching well below middle of face, first segment short, third a little longer than second; arista distinctly longer than antennae, short plumose to tip, proximal segments short but distinct; proboscis rather slender, hardly two-thirds head height; palpi moderately long, with tips slightly thickened in female; eye bare, oblique, not reaching vibrissal level; cheek about two-thirds eye height. Thoracic chaetotaxy similar to preceding species, but with 3 intraalars and presutural acrostichals; intrapostalar differentiated; hind lobe of calypter wider than long; prosternum and propleura bare. Abdomen rather narrow in both sexes and slightly elongate; first segment without median marginal bristles, second with one pair, third and fourth each with a marginal row, no discs; sternites covered. Legs rather long, fore tarsi moderately slender and exceeding length of tibiae; male claws and pulvilli strongly elongated. Wings not very broad,

reaching a little beyond apex of abdomen; first vein bare, third with one to four hairs near base; hind cross vein slightly nearer bend than small cross vein; first posterior cell closed with petiole usually less than twice length of small cross vein, reaching costa far before wing tip; costal spine strong.

Genotype: *Orestilla primoris*, n. sp.

Orestilla primoris, n. sp.

Male.—Front at vertex 0.31 of head width, equibroad to middle thence widening to 0.48 of same at antennal base; head pale or yellowish in ground color, occiput darker or blackish on upper half; parafrontals, parafacials and cheeks whitish to silvery pollinose; frontal strine reddish yellow, at middle subequal or slightly exceeding parafrontal width; antennae wholly reddish yellow, third segment somewhat narrowed toward rounded apex; arista thickened and brownish near base thence paler to tip; parafacial wider than clypeus, not narrowed downward; cheek sparsely black-haired; palpi yellow; back of head slightly bulged at sides below, pale pollinose, thinly clothed with short white hairs and some coarser black ones behind occipital fringe above.

Thorax black, humeri and scutellum beyond basal margin reddish in ground color, dusted with opaque gray pollen, notum not distinctly vittate; calypters white.

Abdomen reddish yellow with a black dorsal vitta sometimes poorly defined and widening behind to include basal margin of segments three and four, rather evenly dusted with thin white pollen which extends on venter; genitalia reddish; inner forceps very slender, united and tapering to a sharp tip; outer pair much heavier; fifth sternite with a deep V-shaped apical incision, lobes exposed, beset with fine short blackish hairs.

Legs pale reddish, femora darker or blackish on basal half; mid tibia with one good-sized bristle on outer front side near middle; hind tibia not ciliated; claws and pulvilli longer than apical tarsal segment.

Wings subhyaline with a faint uniform tawny tinge; bend of fourth vein obtuse, usually without a stump but sometimes a short one present; epaulets red, subepaulets pale yellow.

Female.—Front at vertex 0.42 of head width (average of three), widening but little to antennal base; outer verticals weak and barely differentiated; third antennal segment nearly twice length of second; abdomen broader at middle and more pointed apically; genitalia retracted, not adapted for piercing; claws and pulvilli short; otherwise similar to male.

Length, 6-7 mm.

Holotype male and allotype female, Cuervo, N. M., June 23, 1940 (D. E. Hardy). Paratypes: 1 male and 2 females, same data as type (R. H. Beamer; L. J. Lipovsky); 2 males and 2 females, Estancia, N. M., June 24, 1940 (R. H. Beamer, L. J. Lipovsky, E. E. Kenaga and L. C. Kuitert); 1 male, Grady, N. M., July 16, 1936 (M. B. Jackson), and one pair in my collection, Red River, N. M., August 14, 1940, 9000 ft., (F. Snyder).

Nicephorus, n. gen.

Related to *Opsotheresia*, but much less robust in build; antennal axis higher up and close to eye middle; haustellum barely exceeding one-half head height; eye reaching to vibrissal level, etc.

Head a trifle wider than high, with long horizontal oral profile at right angle to occipital, flat frontal profile strongly sloped and one-third longer than facial; antennal axis shorter than oral, latter about three-fourths head height; face moderately impressed on sides with a high wide median carina, flattened crest of latter gently arcuate in profile; facial ridges flat, bearing a few bristly hairs next to vibrissae; latter considerably above oral margin; parafacial bare, equibroad downward but narrower than clypeus; epistoma subnasutely produced and slightly prolonged downward; bases of antennae well separated, first segment flush, third slender, nearly three times second and reaching lower third of face; arista barely longer than third antennal segment, long plumose to tip, basal segments short; frontal bristles in a single row extending to base of antennae; ocellars proclinate, divaricate; outer verticals and two proclinate orbitals in female; eye bare, nearly vertical; cheek one-fourth to one-third eye height; proboscis rather slender but not very long, labella small; palpi slender, slightly thickened at tip. Thoracic chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; intraalar 2 (none near suture); supraalar 4 (only two large); humeral 3-5; posthumeral 2; presutural 1 (outer); notopleural 2; postalar 2; intrapostalar barely differentiated; pteropleural 1 (moderately long and 2 or 3 weaker bristles in front and behind); sternopleural 2, 1; scutellum with 2 lateral and 1 slightly smaller decussate apical pair besides an arcuate row of discals behind middle; propleura haired; prosternum and sides of postnotum beneath calypters bare; infrascutellum well developed. Abdomen subovate, slightly wider than thorax; last two segments each with a row of marginal bristles; sternites covered; genitalia small and retracted. Legs moderately long and slender; hind tibiae short ciliate; male claws and pulvilli short. Wings ordinary in shape; first vein bare, third with three to five minute hairs near base; first posterior cell narrowly open well before wing tip; bend of fourth vein obtuse, stumpless, close to hind margin of wing; hind cross vein oblique, joining fourth nearer bend than small cross vein; costal spine vestigial.

Genotype: *Nicephorus floridensis*, n. sp.

Nicephorus floridensis, n. sp.

Male.—Front at vertex 0.22 of head width, nearly equibroad to middle thence widening moderately to antennal base; sides of front and face with satiny yellow pollen on reddish ground color becoming blackish below cheek groove; frontal vitta deep red, moderately narrowed upwards but much wider than parafrontal; basal segments of antennae reddish, third infuscated beyond arista; latter black, thickened at base; palpi yellow, sparsely short-haired; cheek one-third eye height; back of head flat, gray pollinose, moderately clothed with short pale hairs.

Thorax and scutellum black, gray pollinose, notum with three subshiny black vittae extending nearly to scutellum, the median one before suture divided by parallel pollen bands leaving a very narrow but distinct dark stripe on either side of a wider middle one; calypters white.

Abdomen black, sides and anal segment largely reddish, dusted with changeable gray pollen above which extends to hind margin on all segments but more thinly so on the last; genitalia red, outer forceps broad or plate-like; inner pair small, united, tapering to a fine tip; fifth sternite red, lobes darker, exposed and widely separated apically.

Legs black with trochanters rather sharply contrasting reddish yellow; mid tibia with two small bristles near middle on outer front side; tarsi slender.

Wings hyaline with a slight yellowish tinge becoming gray towards hind margin; veins including costa yellow; epaulet black, subepaulet pale yellow.

Female.—Front at vertex 0.32 of head width widening gradually to antennae; parafrontal and parafacial gray to silvery, latter nearly equal clypeal width; cheek about one-third eye height; abdomen black on sides, second segment with pair of median marginals.

Length, 7-9.5 mm.

Holotype male and allotype female, Hilliard, Florida, July 24, 1939 (R. H. Beamer). Paratypes: 17 males and 6 females all from Florida as follows: Hilliard, August, 1930 (Paul W. Oman), July and August, 1939 (R. H. Beamer); Branford, July, 1930 (R. H. Beamer and J. Nottingham), August, 1939 (D. E. Hardy); Suwannee, August, 1939 (R. H. Beamer).

Masiphyomyia, n. gen.

Allied to *Siphosturmiopsis* and *Siphosturmia*, but differing from both in having hairy eyes.

Head fully one-third wider than high, oral margin axis four-fifths antennal, which is near or just above eye middle, facial profile concave below and a trifle longer than sloped frontal; face slightly impressed, its lateral ridges flattened and bare, diverging downward; epistoma gently bowed forward and nearly equal clypeal width; vibrissae slightly above oral margin; parafacial bare, narrowed downward; second antennal segment somewhat elongate, third segment in male barely two and in female slightly over two times second; arista bare, moderately thickened on basal half, middle segment twice longer than thick; frontal rows strongly divergent with two or three bristles beneath antennal base; ocellars large, proclinate; outer verticals developed and two proclinate orbitals in female; haustellum less than one-half head height but not very stout; palpi strongly bowed upwards, stout in female; cheek about one-fifth eye height; eye moderately long pilose, reaching to vibrissal level; back of head flat with lower margin behind oral cavity somewhat bulged. Thoracic chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; intraalar 3; supraalar 3; notopleural 2; presutural 2; humeral 3-4; posthumeral 2; postalar 2; intrapostalar moderately strong;

sternopleural 2, 2; pteropleural 1 (short); scutellum with 3 lateral, 1 good-sized decussate apical and 1 smaller discal pair; prosternum bristled, propleura and sides of postnotum beneath calypters bare; infrascutellum normally developed. Abdomen short, subconical, anal segment with truncate tip in female; basal segments each with one pair of median marginal bristles (weak on first); third segment with a marginal row and fourth with somewhat smaller irregularly spaced bristles on apical half above; sternites largely covered; female genitalia not adapted for piercing. Legs moderately bristled; hind tibiae ciliate; claws and pulvilli slightly elongate in male. Wings extending well beyond tip of abdomen, ordinary in shape; first vein bare, third with one or two hairs near base; bend of fourth vein rectangular to obtuse, without stump or fold; first posterior cell narrowly open far before wing tip; hind cross vein joining fourth nearer bend than small cross vein; last section of fifth vein short; costal spine vestigial.

Genotype: *Masiphyomyia alearis*, n. sp.

Masiphyomyia alearis, n. sp.

Male.—Front at vertex 0.36 and at base of antennae 0.42 of head width (one specimen); parafrontal pale golden, very sparsely clothed with fine hairs, at middle nearly twice wider than frontal stripe; upper two frontals stout and reclinate, preceding ones weaker, decussate to antennae, two below base of latter and not reaching level of arista; parafacial and cheek cinereous; antennae black, third segment moderately wide to rounded tip; palpi yellow, slender to tips; back of head gray pollinose, clothed with pale hairs.

Thorax black dusted with gray pollen tinged with yellow on notum; latter marked with four narrow vittae before suture and five behind, outer pair broadly interrupted at suture and the inner ones stopping shortly behind same; scutellum reddish yellow, beset with short erect bristly hairs; calypters opaque, white.

Abdomen broadly reddish on sides and venter almost entirely so; last three segments with extensive grayish pollen which is narrowly interrupted on median line; hairs on intermediate segments rather fine and erect but not very long; genital segments small, retracted; inner forceps black, short, divided beyond middle but not divergent, moderately thick and straight in profile; outer forceps yellowish, shorter but nearly as thick as inner ones; fifth sternite with U-shaped apical incision, lobes faintly pollinose, bearing only a few minute black hairs on inner margin.

Legs black; mid tibia with one stout bristle on outer front side near middle; claws and pulvilli about equal length of apical tarsal segment.

Wings gray hyaline; small cross vein far before apex of first; epaulets and subepaulets black.

Female.—Front at vertex 0.36 of head width (one specimen) widening gradually toward antennal base; second antennal segment reddish; palpi

strongly swollen beyond middle; abdominal segments two and three above with hairs wholly depressed; claws and pulvilli short.

Length, 8 mm.

Holotype male and allotype female, in my collection, College Station, Texas, May 15, 1943 and May 7, 1938 (H. J. Reinhard).

***Masiphyomyia paralis*, n. sp.**

Male.—Front at vertex 0.36 of head width, hardly widening to middle thence rapidly so to about one-half head width at antennal base; parafrontal cinereous, moderately clothed with fine erect hairs, which extend beneath lowermost frontals, several good-sized bristles on anterior part of parafrontal outside main frontal rows; latter descending to level of arista, with three to five bristles below antennal base; second antennal segment one-half to three-fifths length of third; thorax thinly gray pollinose, notum subshining and indistinctly vittate.

Length, 7-8.5 mm.

Holotype male, in my collection, Otero Co., New Mexico, July 17, 1926. Paratypes: 1 male, same data as type, and 2 males, San Jacinto Mts. California, July 21, 1929 (Paul W. Oman) and (L. D. Anderson) in the Kansas University Collection.

***Masiphyomyia comosa*, n. sp.**

Male.—Similar to *alearis*, differing mainly as follows: Front slightly wider, at vertex 0.38 of head width; parafrontals cinereous, rather thickly clothed with long hairs which extend downward nearly to middle of parafrontals; frontal rows double anteriorly, four or five bristles beneath base of antennae extending to arista level, uppermost three bristles stout and reclinate; second antennal segment over one-half length of third; parafacial two thirds clypeal width; cheek nearly one-third eye height; thorax lightly dusted with gray pollen, notum subshining and indistinctly vittate; abdomen with longish erect hairs on most of upper surface; second segment with two pairs of median marginals but outer one usually weak.

Length, 7-8.5 mm.

Holotype; male, in my collection, Boulder, Colorado, 6600 ft., June 30, 1932 (M. T. James). Paratypes: 1 male, San Bernardino Co., California, June 1, 1930 (D. G. Hall), and 1 male, labeled "Waterton Park, Alta., *Incisalia*, Rec: B C 2502, F. I. Survey 1941, Em. (Incubator) Feb. 13, 1942," in the Canadian National Collection.

The last mentioned specimen may not prove conspecific. It is blacker in general aspect; the antennae are somewhat longer, with third segment nearly twice longer than second; the hairs below lower frontals are sparser, shorter and do not reach to middle of parafacial.

***Masiphyomyia longicornis*, n. sp.**

Similar to *alearis* in most respects, but at once distinguished from all related species described above by the longer antennae; third segment of latter reaching nearly to oral margin and four to six times length of second;

arista thickened nearly to apical fourth, middle segment slightly elongate; male vertex 0.37 and female 0.39 of head width; female palpi bowed as usual and moderately thickened apically; hairs on intermediate abdominal segments coarse or bristly and erect in both sexes; male pulvilli shorter than last tarsal segment.

Length, 7.5 mm.

Holotype female, allotype male, and paratype female in my collection, Brewster Co., Texas, August 8, 1937 (R. H. Baker).

Key to Species of *Masiphyomyia*

1. Third antennal segment at most barely exceeding twice length of second 2.
 Third antennal segment at least three times length of second, (Texas) *longicornis*, n. sp.
2. Two reclinate prevertical bristles; parafacial below lowermost frontals bare to sparsely haired 3.
 Three reclinate prevertical bristles; parafacial moderately to thickly haired from lower frontals downward to level of mid face, male only, (Colorado, California, Alberta) *comosa*, n. sp.
3. Parafrontals pale to golden yellow; thorax and scutellum with heavy yellowish gray pollen above; hairs on intermediate abdominal segments erect in male, depressed in female, (Texas) *alearis*, n. sp.
 Parafrontals cinereous; thorax and scutellum thinly gray pollinose above and subshining; hairs on intermediate abdominal segments bristly and erect in both sexes, (New Mexico, California) *paralis*, n. sp.

Zenillia collina, n. sp.

Close to *Z. hyphantriae*, from which it differs in having second antennal segment wholly black and discals on intermediate abdominal segments. Also related to *Z. blanda*, but the front is distinctly wider, less prominent in profile, abdomen more heavily and uniformly pollinose, etc.

Male.—Front at vertex 0.27 of head width, hardly widening downward to middle thence more rapidly so to equal eye width at antennal base; sides of front and face with heavy gray pollen, almost silvery on latter; frontal vitta deep velvety brown, gradually narrowed upwards and cleft at ocellar triangle, latter with a pair of strong proclinate bristles and numerous fine hairs; parafrontal wider than vitta, clothed with sparse fine hairs on entire length; inner verticals strong, reclinate; frontals in single row, two or three bristles diverging beneath antennal base and two stout reclinate prevertical bristles; no proclinate orbitals; face moderately receding, deeply impressed, its ridges with a few bristles and fine hairs on lower fifth or sixth; epistoma short, in clypeal plane; vibrissae stout, decussate, on oral margin; parafacial bare, narrowed to less than width of third antennal segment on lower extremity; antennae reaching nearly to oral margin, basal segments short, third rather slender, straight on front edge and rounded on apex, five or six times longer than second; arista black, micro pubescent, thickened on basal fourth to third, proximal segments short; eyes large, moderately long

pilose; cheek hardly one-sixth eye height, gray pollinose, with a few hairs on lower edge; proboscis short, labella large, pale yellow; palpi yellow, moderately thickened apically, beset with numerous short black hairs except on extreme base; back of head flat, clothed with only pale hairs which are longer and thicker below middle.

Thorax and scutellum black, densely gray pollinose, marked with four dark dorsal vittae, outer pair broken at suture and inner stopping shortly behind latter. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; intraalar 3; supraalar 3; postalar 3; sternopleural 2, 1 (lower one small); pteropleural 1 (moderately long); intrapostalar distinct; notopleural 2; humeral 3; post-humeral 2; presutural 2; scutellum with 3 lateral (hindmost strong and divaricate), 1 discal and 1 weak decussate upturned apical pair; prosternum haired to bristled on sides; propleura bare; clypters white; infrascutellum normally developed.

Abdomen black, last three segments wholly gray pollinose; median marginals smallish on first segment but distinct, stouter pair on second; discals on intermediate segments sometimes irregularly spaced; third and fourth segments each with a marginal row besides a discal row on last; genitalia rather large but retracted; inner forceps heavy, weakly keeled behind to apical third thence sloped obliquely forward and divided to blunt apex; outer forceps fingerlike, longer than inner ones and slightly bowed forward before apex, outer side shiny brown, clothed with black hairs; penis black, terminating in a vase-like structure, deeply grooved in front and prolonged rearward at apex in a transparent membrane supported by a slender chitinated process on hind side; sternites covered.

Legs black; hind tibia short ciliate; middle tibia with one good-sized bristle on outer front side near middle; hind coxa with two bristly hairs on posterior apical margin; claws and pulvilli exceeding length of apical tarsal segment.

Wings hyaline; first vein bare, third with one or two hairs near base; first posterior cell narrowly open well before wing tip; bend of fourth vein broadly rounded, without stump or fold, beyond nearly straight and in plane of hind cross vein which joins fourth less than one-third distance from bend to small cross vein; costal spine vestigial; equalets blackish.

Female.—Front at vertex 0.35 of head width, gradually widening downward; outer verticals vestigial; two strong proclinate orbitals; antennae about three-fourths length of face, second segment slightly reddish; genitalia retracted, ventral; claws and pulvilli shorter than apical tarsal segment.

Length, 8.5-9 mm.

Holotype male, and allotype female, Chiricahua Mts., Arizona, July 4, 1940 (R. H. Beamer). Paratypes: 8 males, same data as type and 2 males collected by Dr. Beamer in same locality, August 7, 1941.

Sturmia crescentis, n. sp.

Close to *S. limata* Coquillett (*Zizyphomyia celer* Townsend) but at once distinguished by the narrower vertex in both sexes, abdomen blacker and

more shiny in female and anal segment with a basal pollen band above in male.

Male.—Front at vertex 0.34 of head width, equibroad to middle thence gradually widened to 0.45 of same at antennal base; sides of front and face including cheeks and posterior orbits gray to silvery pollinose; median vitta velvety reddish brown, at middle subequal parafrontal width; verticals two pairs; ocellars strong, proclinate; two stoutish reclinate prevertical bristles and two or three frontals beneath antennal base; parafacial bare, a little narrowed downward; face moderately impressed, espistoma short and broad, facial ridges with bristly hairs on lowest fourth; vibrissae on oral margin; antennae black tinged with red basally, third segment rather slender, two and one-half to three times second; arista blackish, moderately thickened on basal two-fifths, proximal segments short; proboscis short, palpi brown with tips usually paler or yellow; eyes bare; cheek about one-fifth eye height, clothed with black hairs.

Thorax and scutellum black, gray pollinose, notum with four blackish vittae before suture and five behind. Chaetotaxy: acrostichal 3, 3; dorso-central 3, 4; intraalar 3; supraalar 3; presutural 2; posthumeral 2; humeral 4; notopleural 2; postaalar 2; intrapostalar strong; sternopleural 2, 2; pteropleural 1 (smaller than sternopleural); scutellum with 3 lateral, 1 decussate upturned apical and 1 good-sized reclinate discal pair; prosternum setose; propleura bare; calypters white.

Abdomen black, with silvery pollen on broad bases of intermediate segments at middle above and on narrow basal margin of fourth, remainder of segments polished or shiny; one pair of median marginal bristles on first two segments and marginal row on last two, besides a discal row on anal segment; venter shiny black, third and fourth segments with patches of appressed short soft hairs extending upwards on sides; hypopygium small, retracted; inner forceps slender and straight in profile, divided apically but not divergent, apex obliquely narrowed; outer forceps considerably thicker and shorter, beset with fine short hairs on outer side; fifth sternite deeply incised, lobes black with a few long hairs on inner margin.

Legs black, moderately bristled; mid tibia usually with one large and two smaller bristles near middle on outer front side; hind tibia subciliate; claws and pulvilli short.

Wings gray hyaline; third vein with two or three hairs near base; first posterior cell open far before wing tip; hind cross vein slightly nearer bend than small cross vein; costal spine minute.

Female.—Front at vertex 0.35 of head width gradually widening downward to antennae; two proclinate orbitals; second antennal segment reddish, about one-half length of third; fourth abdominal segment pollinose on basal third to half; anal orifice narrow, elongate; genitalia not adapted for piercing.

Length, 5.5-7 mm.

Holotype male and allotype female, College Station, Texas, May 1,

1929 (H. J. Reinhard). Paratypes: 42 males and 19 females, same locality as type, April to October, 1917-44 (H. J. Reinhard); 1 female, Dilley, Texas, June 1, 1934 (H. B. Parks); 1 male "Oklahoma, June 6, 1931," without collector's label; 1 male, Amherst, Ohio, July 6, 1935 (H. J. Reinhard), all in my collection; 1 male, Babylon, L. I., New York, June 24, 1933 (F. S. Blanton); 2 males, Franklin, North Carolina, August 17, 1939 (R. H. Beamer); 1 female, Cherokee Co., Ks., 888 ft. 1915 (R. H. Beamer); 1 female, Douglas Co., Ks., 900 ft. (F. H. Snow); and 1 female, Carlsbad, New Mexico, June 17, (E. M. and R. H. Painter), in the Kansas University Collection.

Peleteria mediana, n. sp.

A robust blackish species with the front considerably more prominent than in most related forms. The inner genital forceps in the male are deeply grooved behind as in *P. apicalis* Walker (*confusa* Curran) but without a prominent median lobe.

Male.—Front at vertex 0.42 of head width, slightly narrowed before ocellar triangle thence widening rapidly downward; parafrontal blackish, wider than median vitta; parafacial and cheek with satiny yellowish pollen; three to five pairs of proclinate orbital and two pairs of vertical bristles; frontal rows strongly divergent beneath antennal base and usually three bristles on lower part of parafacial near eye margin; basal antennal segments reddish tinged with black, third wholly black, strongly convex on front edge, shorter than second segment; palpi yellow, very slender and subequal length of haustellum; latter over three-fifths head height; back of head thickly clothed with long pale hairs.

Thorax black, lightly dusted with grayish pollen; notum subshiny but with four moderately broad black vittae defined before suture; scutellum reddish yellow except on narrow basal margin; acrostichal 3, 3; dorso-central 4, 4; sternopleural normally 2, 1; pteropleural longer than sternopleural; scutellum with 4 lateral, 1 strong decussate apical, 1 preapical and several irregularly spaced discal pairs; calypters opaque white.

Abdomen black with sides of intermediate segments more or less reddish and basal margin of same sprinkled with changeable gray pollen, anal segment with similar pollen on basal half or more; median marginal bristles on first segment variable and sometimes only one bristle developed; second segment with one stout pair, third with marginal row and fourth with numerous irregularly spaced bristles on apical half above; genital segments smallish, retracted; inner forceps moderately broad, deeply grooved behind and obliquely truncate as viewed from rear, strongly bowed forward apically, bearing a small median lobe which is but slightly more prominent than lateral apical extremity; outer forceps slender, tapering to simple tip; fifth sternite shiny black, lobes normally divergent and evenly rounded apically; sternites exposed.

Legs black, tibiae reddish yellow; claws and pulvilli longer than apical tarsal segment.

Wings subhyaline, small cross vein infuscated; first posterior cell open far before wing tip; hind cross vein much nearer bend than small cross vein; costal spine minute; epaulet black.

Female.—Front at vertex 0.46 of head width; parafrontals reddish in ground color; abdomen wholly black and last three segments with heavier gray pollen than in male; first segment usually without median marginals; fore tarsi moderately widened, claws and pulvilli short.

Length, 11–13 mm.

Holotype male and allotype female, Waldport, Oregon, July 11, 1935 (Jack Beamer). Paratypes: 6 males and 3 females, same data as type; 1 female, Cliffdell, Washington, July 7, 1935 (E. I. Beamer); 3 males and 3 females, in my collection, Westport, Washington, May 28, and July 7, 1933 (Chas. H. Martin, J. Wilcox); 1 female, Corvallis, Oregon, May 10, 1930 (J. Wilcox); 1 female, Golden Gate Dunes, California, July 22, 1931 (Chas. H. Martin).

PRONECUPULATUS, A NEW GENUS OF TYDEIDAE (ACARINA) FROM MEXICO

EDWARD W. BAKER

United States Department of Agriculture, Agricultural Research Administration,
Bureau of Entomology and Plant Quarantine

Pronecupulatus, n. g.

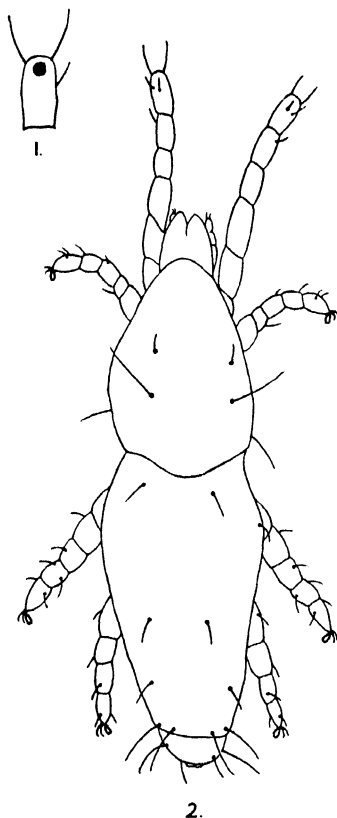
Pronematus-like in having no claws or tarsal pads on the first pair of legs, but differing in having what appears to be a hard, chitinous, cup-like organ on the lower distal surface of tarsus I. *Pronecupulatus anahuacensis*, n. sp., is designated as the type of the genus.

Pronecupulatus anahuacensis, n. sp. (Figs. 1, 2)

Small, elongated mite; white; skin finely striated; body furrow curving posteriorly on dorsum, entire (plain in fresh mount but almost impossible to see after a short time). Rostrum of normal size; venter with a pair of hairs out under segment I of palpus. Palpus short, reaching to tip of rostrum; segment II twice as long as III; III and IV appearing to be of the same length; segment IV with at least 2 simple, short (same length as segment) end hairs. Second mandibular segment probably short and curved. Cephalothorax 61 μ long and 64 μ wide; no eyes; sensory hairs plain, whiplike, about 33 μ long; thoracic shoulder hairs 22 μ long; others about 11 μ long. Abdominal hairs about 11 μ long, except those on posterior margin, which are 22 μ long with the center rear pair 11 μ long. Abdomen with 2 posterior, dorsal, transverse sutures. Female genital opening large (hairs, if any, not seen as flaps folded over). Anal opening far to the rear. Legs simple, short; leg IV reaching to rear edge of body; segments simple, sparsely haired.

Claws and strongly haired tarsal pads on legs II, III, and IV. Leg I without claws or pads, with 2 dorsal end hairs (about length of segment), a median, dorsal, clavate seta of medium length besides a simple hair, and ventrally and distally what appears to be a chitinous cup-like disc. Length with rostrum 216 μ , width 78 μ . Described from a single female.

This mite was found in lichens on trees along the drive to Chapultepec Castle, Mexico, D. F., March 15, 1943. It will be deposited in the United States National Museum, Washington, D. C., under Type Catalogue Number 2438.



EXPLANATION OF PLATE

1. Venter of tarsus I showing the chitinous cup-like organ.
2. Adult female.

A NEW SPECIES OF **BRACON** (HYMENOPTERA,
BRACONIDAE) FROM KANSAS

ROY D. SHENEFELT

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***Bracon pascuensis* n. sp.**

Runs to couplet 13 in Muesebeck's key¹ but differs from *scanticorum* Viereck in having the ovipositor sheaths only half to two-thirds as long as the abdomen beyond second tergite, in the more or less roughened propodeum, and in lacking the lateral oblique foveolate furrows on the propodeum. From *pyralidiphagus* Muesebeck, to which it appears to be most closely related, it differs in having a median longitudinal roughened groove on the propodeum instead of a median longitudinal carina.

Female: Length $2\frac{1}{2}$ - $3\frac{1}{2}$ mm. Ovipositor $\frac{1}{2}$ to $\frac{3}{4}$ mm. Head transverse, appearing from above to be about one-fourth broader than long; antennae 27-segmented in type, shorter than body; first flagellar segment approximately two and one-half times as long as thick and about one-fifth longer than second; all flagellar segments much longer than broad; malar space about one-fourth shorter than first segment of flagellum; face finely granular and opaque; frons minutely reticulately sculptured, sometimes only very weakly so, shining; eyes about twice as broad as temples and very slightly emarginate opposite antennal bases; clypeo-stomal line about twice the length of the tentorio-ocular line; face about two-thirds as long from lower margin of antennal sutures to ventral margin of clypeus as broad between eyes at the level of the lower margin of antennal sutures; ocell-ocular line about four times the diameter of a lateral ocellus; posterior and lateral ocellar lines subequal and twice the diameter of a lateral ocellus in length. Notaulices broadly impressed, sparsely pubescent anteriorly, more thickly so posteriorly; mesonotum and mesopleura smooth and polished; scutellum a little broader at base than long, with scattered hairs over its surface; propodeum varying from nearly smooth to roughened over most of its surface, usually roughened apically, with a stub of a median ridge at apex and a distinct median coarsely roughened groove from the anterior end of the stub to the base of the propodeum; metapleura polished on anterior two-thirds, roughened posteriorly. Stigma rather narrow, not angular; radius originating much beyond middle of stigma; radial cell short, attaining the wing margin at a point from about one-half to three-fourths the length of the stigma from the apex of the wing; first abscissa of radius about one-third the length of the first intercubitus and one-third to one-fourth the length of the second abscissa of radius. Posterior femora stout, about two and three-fourths times as long as broad. First abdominal tergite roughened laterally and apically, usually smooth centrally, rather sharply angled at

¹ Muesebeck, C. F. W. "A Revision of the Parasitic Wasps of the Genus *Microbracon* Occurring in America North of Mexico."—Proc. U. S. Nat. Mus., 67, 1925, Art. 8, pp. 1-85.

the spiracles; second tergite subequal in length with the third, granular or granularly rugose and usually more strongly roughened basally in the middle, more or less emarginated posteriorly; suturiform articulation broad, shallow, very finely crenulated, usually bent forward distinctly in the middle and slightly so at the sides, but sometimes practically straight; third, fourth, fifth and sixth tergites granular, the sculpture becoming weaker posteriorly; sculpture of abdomen varying from minutely reticulate to strongly granular.

Reddish brown in color; head with face brown, vertex piceous, occiput and temples yellowish brown to piceous; antennae fuscous to piceous, darkest on distal two-thirds; mesonotal lobes from reddish brown to black; notaulices brown; scutellum, propodeum, and mesosternum brown to piceous; legs, including all coxae, reddish or yellowish brown to apical third of tibiae, fuscous beyond (in some cases reddish brown to apex of last tarsal segment which is dark brown); abdomen reddish or yellowish brown, the first tergite and median basal area of second sometimes contrastingly dark brown to piceous; ovipositor sheaths black; wings nearly hyaline, stigma yellowish to brown, nervures brown.

Male: Essentially as in female after allowance is made for the usual sexual differences. Antennae 29-segmented in allotype.

Host: Unknown.

Type-locality: Stafford Co., Kansas.

Allotype-locality: Manhattan, Kansas.

Type: Female with the following data: "Stafford Co. Ks. VI-30-'34 D. A. Wilbur Salt Marsh." In the collection of Professor Wilbur at Kansas State College.

Allotype: Manhattan, Kansas, IV-19-'30, D. A. Wilbur. From pasture variety plots at the Agronomy Farm, Kansas State College. In the collection of Professor Wilbur.

Paratypes and their location in collections as follows:²

2 (KS)—Kansas State College, Manhattan, Kansas. (Kan.) University of Kansas, Lawrence, Kansas. (KSW)—Collection of Professor D. A. Wilbur, Manhattan, Kansas. (USNM)—U. S. National Museum, Washington, D. C. (RDS)—the author's collection.

KANSAS

Douglas Co.: X-10-1933 H. M. Smith 1 female (KS).

Riley Co.: V—Marlatt 1 female (KS). IX-6—J. B. Norton Ac. 1328 1 male (KS). IX-6—E. E. Faville 1 female (KS). IX-24—E. E. Faville 1 female (KS). IX-28—E. E. Faville 1 female (RDS). IX-29—E. E. Faville 1 female (KS). X-1—E. E. Faville 1 female (KS). X-6—E. E. Faville 1 male (RDS).

Manhattan—all collected by D. A. Wilbur.

V-2-1930 on mixture of grasses 1 male (Kan). VII-19-1930 on white clover 1 female (KSW). VIII-1-1930 on Brome and orchard grass mixture 1 male (KSW). VIII-23-1930 1 male (KSW). VIII-29-1930 on timothy 1 male (RDS). VIII-29-1930 1 female (KSW). IX-15-1930 on Sainfoin 1 male

(KSW). IX-19-1930 1 female (KSW). IX-27-1930 on crested wheat grass 1 female (KSW). IX-27-1930 on timothy 1 female (KSW), 1 female (RDS). IX-27-1930 on tall oat grass 1 female (RDS). IX-27-1930 on Sainfoin 1 female (KSW). X-3-1930 on upland native grasses 1 female (KSW). XI-1-1930 on upland native grasses 1 female (KSW). XI-11-1930 on upland native grasses 1 female (KSW). V-26-1933 on upland native grass pasture 1 male (KSW). VI-28-1933 on upland native grass pasture 1 female (KSW). IX-17-1933 on upland native grass pasture 1 male (KSW). V-5-1934 on Brome-Orchard grass mixture 1 male (USNM). V-7-1934 on Kentucky blue grass pasture 1 male (Kan). IX-23-1934 on Brome-Orchard grass mixture 1 male (KSW). VIII-26-1935 on upland native prairie grass pasture 1 male (KSW). X-19-1936 on upland native prairie grass pasture 1 female (Kan.). VII-8-1937 on upland native prairie grass pasture 1 male (KSW). VIII-28-1937 Kentucky blue grass pasture 1 female (KSW). VIII-30-1937 on upland native prairie grass pasture 1 female (KSW). IX-14-1937 on upland native prairie grass pasture 1 female (USNM), 1 female (RDS).

MICHIGAN

Cheboygan Co.: VII-9-1934 M.D.P., Colr. 1 male (KS).

THE GENUS *ILYOCORIS* STAL (Hemiptera, Naucoridae)

ROBERT L. USINGER

University of California, Davis

Ilyocoris cimicoides (Linnaeus) is one of the best known European water bugs. The name is frequently given as *Naucoris cimicoides* but Stal (1861) and others have shown that Geoffroy (1762) misidentified the Fabrician *maculatus* as *cimicoides* when he first proposed the genus *Naucoris*. Hence *Naucoris* is restricted to *maculatus* and its allies and Stal's genus *Ilyocoris* must be used for *cimicoides*.

In *Ilyocoris* the front femora are only moderately incrassate with their inner antero-basal angles not produced, forming a continuous curve with the trochanter. The upper front margin of each femur is evenly pubescent throughout its length. The species of *Ilyocoris* range from 11 to 16 mm. in length.

Naucoris has tremendously incrassate front femora with the inner antero-basal angle well separated from the small trochanter. This angle bears a dense mat of hairs and the upper front margin of the femur is not pubescent. The *Naucoris* species are relatively small, never exceeding 10 mm. in length.

Naucoris is widespread in the Old World with species described from the southern Palaearctic region and from the Ethiopian, Oriental and Aus-

tralian Realms. *Ilyocoris*, on the other hand, is exclusively Palaearctic. *Cimicoides* has been recorded from England to Manchuria and from Sweden and Siberia to Italy and Turkestan (Oshanin, 1906, and Kiritshenko, 1930).

Lindberg (1922) described the "variety" *jonicus* from the Island of Corfu. *Jonicus* is said to differ only in its smaller size, *cimicoides* being from 12 to 14 mm. in length whereas *jonicus* is only 11½ mm. This would appear to be a rather trivial difference considering the range of variation in certain American *Naucorids* but, if constant, would certainly indicate a geographically isolated subspecies. Corfu is just below the fortieth parallel of latitude and this line coincides fairly well with the southern limits of distribution of typical *cimicoides*.

Closely allied to *cimicoides* at the eastern limits of its range is the Japanese *exclamationis* Scott. Although well known in Japan (Esaki, 1932) this species has not been carefully studied in relation to the rest of the Palaearctic fauna. It was unknown to Stal (1876) who listed it under "*Species Naucoridarum incerti loci systematici*." That it is not restricted to the Japanese islands is indicated by two specimens collected by E. C. Van Dyke at Nanking, China, Sept. 27, 1923. These agree perfectly with a specimen in my collection from Fukuoka, Kyushu, Japan, April 30, 1929, collected by Fujino and Matsuo. *Exclamationis* differs from typical *cimicoides* in its smaller size, 11 to 11½ mm. and in its differently colored embolium, the entire basal two-thirds being pale whereas only the lateral margins are pale in *cimicoides*. Here again we have very trivial differences and *exclamationis* occurs south of the fortieth parallel of latitude. Its status as a species or subspecies may be settled by an investigation of the *Ilyocoris* population along the fortieth parallel north of Nanking and south of Harbin, for Dr. Hungerford has recently sent two perfectly typical specimens of *cimicoides* from the Valley of the Ashiko River near Harbin, Manchuria, "under thin ice," Nov. 1-2, 1938, M. J. Nikitin.

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thymus yuccae and were described by H. A. Freeman (Entomological News, 44, No. 9, Nov. 1943) under the name of *Megathymus yuccae stallingsi*; a female form of this subspecies was named *dee*. Type locality of this new subspecies and form is Caldwell, Kansas, and the colony is located at the base of Mt. Lookout on the south bank of Bluff Creek.

A stray specimen of *Strymon leda* (Edw.) was captured in Sumner County this past season.

A series of *Asterocampa clyton texana* (Skin.) was collected by us in Sumner County, Kansas, in 1943. It appears to be native.

—Don B. Stallings, Caldwell, Kansas.

THE FOOD PLANTS OF *ADELPHOCORIS LINEOLATUS*, GOEZE

Curtiss (this *Journal* 14:25-26, 1941) has remarked that I referred to *A. lineolatus* as the "chrysanthemum bug" in 1915. This was a translation of the name "la punaise du chrysantheme" used for *Calocoris chenopodi* (a synonym of *A. lineolatus*) by Truffaut in "Les ennemis des plantes cultivees," p. 391 (Versailles, 1912).

Mr. F. Laing of the Department of Entomology of the British Museum informs me that according to the records there, the distribution of this insect is South Russia and Asia, with food-plants as follows:

Chrysanthemum, beet, lucerne, onion, cotton, mallow, *Salvia*, *Verbascum*, *Chenopodium*, *Euphorbia*, *Artemisia*, *absintheum*, *Eringerum*, and *Carduus*.

To these may be added gooseberry (R.A.E. 3:458) and buckwheat (4:479).

—C. J. Gollidge, F.R.E.S., London, England.

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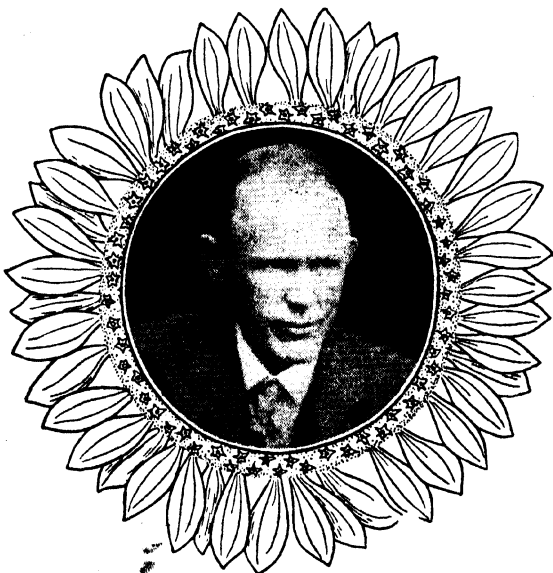
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THE THIRTEENTH OR 1943 ANNUAL INSECT POPULATION SUMMARY OF KANSAS¹

ROGER C. SMITH² and E. G. KELLY³

Kansas Agricultural Experiment Station

This insect population summary for Kansas covers the calendar year 1943 and is the thirteenth in a continuous series which began with the year 1931.⁴ The information recorded here is based on a summary of 333 questionnaires of the score card type from the sources indicated in Table I together with the observations and comments of the authors, their colleagues and of those returning the score sheets.

TABLE I. Source and Numbers of Questionnaires Summarized for this Report

	No. in July	No. in October
Group 1. Entomologists in the state	13	15
Group 2. County Agricultural Agents	75	35
Group 3. Farmers, mostly college graduates	40	35
Group 4. Vocational Agricultural Teachers	43	34
Total reports of each group	174	159
Grand total of all questionnaires summarized for this report	333	

SUMMARY OF WEATHER CONDITIONS (Fig. I and Table II) IN KANSAS BY MONTHS DURING 1943⁵

January had mild weather during most of the month, with an unusually light fall of moisture. A severe cold wave after the middle of the month re-

¹ Contribution No. 533 from the Department of Entomology.

² Entomologist of the Agricultural Experiment Station.

³ Extension Entomologist, Extension Division.

Recognition and appreciation for assistance given during the preparation of this summary are due to the same sources and largely to the same individuals who supplied information for recent, previous reports. They consist of the persons classed in Table I.

⁴ For the other summaries in this series, see the *Journal of the Kansas Entomological Society* for the summaries for 1931 (vol. 5); 1932 (vol. 6); 1933 (vol. 7); 1936 (vol. 10); 1937 (vol. 11); 1939 (vol. 13); and for 1942 (vol. 16) and the *Transactions of the Kansas Academy of Science* for 1934 (vol. 38); 1935 (vol. 39); 1938 (vol. 42); 1940 (vol. 44) and for 1941 (vol. 45).

⁵ Notes and Table II based on Climatological Data: Kansas Section, Weather Bureau, U.S. Dept. of Commerce by S. D. Flora. Vol. 57. 1943.

sulted in some of the lowest January temperatures recorded for the state. Snowfall largely on the 17th and 18th totaled only one to three inches.

February, 1943, was the mildest, most pleasant, and driest February on record. The top soil in the western third of the state dried out and there was some wind erosion. Snowfall was deficient, the total being less than an inch. Wheat began to grow.

March was unusually deficient in precipitation over the state, and the temperature averaged abnormally cold. Abrupt temperature changes were frequent, and extremes for the month were among the greatest on record in the state. The total precipitation for the first three months was scarcely half of normal. Top soil in the western half of the state dried out badly, and there was considerable wind erosion.

April averaged unusually mild over the state, but rainfall in the eastern and south-central counties was exceptionally deficient. Over the eastern third of the state, it was the fourth driest April since 1887. It was also the sixth mildest.

May was exceptionally cool and cloudy. There were record-breaking rains and floods in the southeastern counties, but rainfall was deficient in south-western counties. Below normal temperatures were unfavorable for corn. Fields became weedy due to lack of opportunity to cultivate.

June had above normal temperatures, sufficient sunshine, and heavy rains over all of Kansas except the southwestern quarter. Except in the latter area, it was exceptionally favorable for crops. Damaging floods and delays in farm work again occurred.

July was a favorable month for crop growth, with temperatures averaging above normal, the usual amount of sunshine and slightly below normal rainfall. Most of the rain fell during the first 19 days, and, in some areas, the last three days. The temperature during the first part of the month was comparatively cool but the average for the month was slightly above normal.

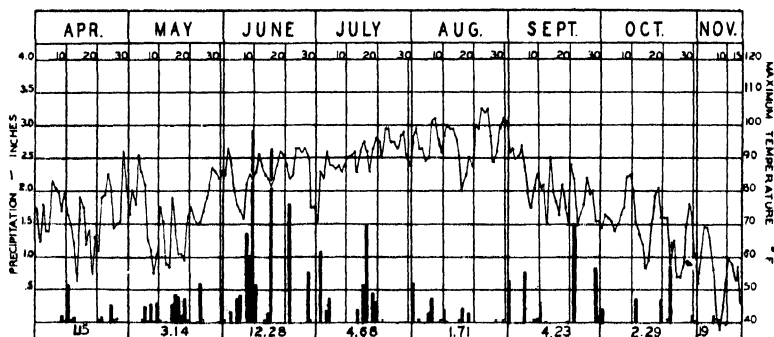


Fig. 1.

TABLE II. Summary of Weather Data for the State of Kansas for the period September 1, 1942 to December 31, 1943

		Temperature in degrees Fahrenheit					Precipitation in inches					
Month		State Average	Maximum	Minimum	Average for 57 years	Departure from normal	State Average	Average for 57 years	Departure from normal	Eastern third	Middle third	Western third
September	1942	66.6°	100°	21°	69.8°	−3.2°	4.48	2.80	+1.65	6.87	4.82	1.74
October	"	57.8°	95°	10°	57.3°	+0.5°	2.80	1.98	+0.82	2.61	2.97	2.83
November	"	45.4°	87°	−3°	43.2°	+2.2°	0.75	1.28	−0.53	1.58	0.45	0.21
December	"	32.4°	73°	−11°	33.2°	−0.8°	1.82	0.86	+0.96	2.76	1.74	0.97
January	1943	30.5°	83°	−28°	29.8°	+0.7°	0.18	0.68	−0.50	0.23	0.17	0.15
February	"	40.4°	82°	4°	33.1°	+7.3°	0.59	0.99	−0.40	0.82	0.70	0.24
March	"	39.5°	94°	−17°	43.4°	−3.9°	0.85	1.42	−0.57	1.38	0.75	0.42
April	"	58.3°	95°	18°	54.9°	+3.4°	1.96	2.56	−0.60	1.71	2.11	2.07
May	"	60.9°	98°	29°	63.9°	−3.0°	4.61	3.81	+0.80	8.23	3.84	1.77
June	"	75.4°	109°	36°	73.8°	−1.6°	5.54	4.04	+1.50	9.18	4.46	2.97
July	"	80.6°	112°	44°	79.2°	+1.4°	2.85	3.11	−0.26	2.79	3.62	2.13
August	"	82.8°	113°	44°	77.9°	+4.9°	2.26	3.15	−0.89	2.82	1.83	2.64
September	"	67.5°	102°	29°	69.7°	−2.2°	2.39	2.82	−0.43	4.19	2.42	0.57
October	"	55.8°	96°	11°	57.3°	−1.5°	1.67	1.98	−0.31	2.45	1.96	0.59
November	"	42.5°	82°	9°	43.2°	+0.7°	0.22	1.26	−1.04	0.30	0.20	0.15
December	"	30.8°	68°	−21°	33.2°	−2.4°	1.50	0.87	+0.63	2.11	1.59	0.81
Average extremes or totals for 1943		55.4°	113°	−28°	55.0°	+0.4°	24.62	26.69	−2.07	35.71	23.65	14.51

August was the hottest since 1938, and had the least rainfall since 1937. Only five Augusts in 57 years and only six summers averaged hotter. Rains were frequent but local, and the total rainfall was below normal. The month was decidedly unfavorable to corn, especially late-planted corn in the southern and western parts of the state.

September had abundant rains in the south and east-central portions of the state but was exceptionally dry in the western and extreme northern counties. Temperatures averaged below normal but there were no damaging frosts. Corn matured early in the month and wheat-sowing was hampered by dry soil, especially in the western part of the state.

October continued to be dry, and conditions were unfavorable for wheat over most of the western and extreme northern counties. Adequate rains occurred elsewhere. The temperatures averaged cooler than usual. The first killing frost occurred on the 15th or 16th.

November was rather cool and unusually dry over the whole of Kansas, this being the fifth month of deficient rainfall.

December had an exceptionally heavy fall of moisture. Cold weather with snow began the second week and continued throughout the month.

CROP PRODUCTION SUMMARY FOR 1943⁶

The year 1943 was excellent for crops in Kansas. Wheat production was 144,201,000 bushels, making it one of the largest crops in the state, although it was 62,574,000 bushels less than in 1942, which was second only to the 1931 crop of 252,000,000 bushels. Excellent yields were obtained in the northwestern areas, but they were reduced by late spring freezes and dry weather in south-western counties and by these factors and hessian fly in the south-central counties.

Oat production was estimated to have been 45,766,000 bushels which is only slightly below the 46,232,000 bushels in 1942.

Barley production was estimated at 15,330,000 bushels which compares with 17,186,000 bushels for 1942 and 26,520,000 bushels in 1941.

Alfalfa seed production in 1943 was estimated at 199,000 bushels or 1.4 bushels an acre compared with 156,000 bushels and 1.3 bushels an acre in 1942.

DESCRIPTIVE ACCOUNT OF THE MORE IMPORTANT INSECT ACTIVITIES AND CLIMATIC RELATIONSHIPS DURING 1943

The **alfalfa plant bug**, *Adelphocoris lineolatus* (Goeze) was found more readily in Riley County than ever before. This species while yet uncommon, appears to be increasing.

Ants. Winged forms of the genera *Cremastogaster* and *Monomorium* swarmed forth in unusual numbers the latter part of September and early October. They prompted much correspondence and many inquiries as to whether they were termites. They were reported widely in the state.

The **kafir ant** was scored at 2 for Elk County by R. F. Nuttelman. This species is destructive to newly planted sorghum seed in that region of the state. Weather in 1943 was not favorable to this species.

The **mound building ant** was observed just west of Abilene, which is the farthest east this species has been seen. The colony was on flat ground and had no mound.

Several species of **aphids** were in outbreak during 1943, while many others species were less plentiful than usual.

Pea aphids occurred in outbreak numbers in counties along the Arkansas River and in other river valley counties. In many regions, the first crop of alfalfa was either lost or seriously reduced by them. First reports were received from Pawnee and Barber Counties the latter part of March. By early April, the aphids had reached outbreak numbers in Pawnee, Barton, Barber, Stafford, Finney, Edwards and Thomas Counties. Later injured spots and fields of alfalfa were observed in Riley, Saline, McPherson, Harvey, Reno, Kingman, Harper, Sedgwick, Sumner, Hamilton, and Wallace Counties. They caused some damage also in Norton, Decatur, and Rawlins Counties in north-

⁶ From Kansas 1943 Crop Review, Kans. State Bd. of Agr., Agricultural Statistics Division, Dec. 20, 1943. Mimeographed Release.

western Kansas, especially in the Sappa creek valleys, and slight damage in Sheridan and Graham Counties.

In Pawnee County, the loss was estimated by the county agent at a half ton of alfalfa an acre. This county also had large number of aphids in 1942. Pea aphids became numerous in counties north of U.S. highway No. 24, but little or no visible damage was seen or reported. They caused visible injury at the Hays and Colby experiment stations. These insects were plentiful in alfalfa fields in eastern counties, but were too late in the season to cause appreciable hay loss. No loss of alfalfa stands was seen or reported. During the summer, pea aphids were as scarce as usual and they did not increase above normal numbers during the fall. They were present, however, on young alfalfa.

Lady beetles, which reached large numbers by early May, had destroyed most of the aphids in the earlier-infested fields by the latter part of May.

The first growth of alfalfa in 1943 had little bloom. Early cutting was unfavorable to the aphids, and the second growth gave excellent yields.

Many reporters also mentioned this species on garden peas, but apparently little damage was done.

The **green bug** again threatened to develop to outbreak proportions but failed to do so. While this aphid was more plentiful than usual in winter barley, oats and wheat, it was not as common as in 1942, and injury was confined largely to small areas or spots of thin wheat as on poor land. These effects were accentuated by the prevailing dry weather. Early reports came from Harper and Kiowa Counties. By the first of May, the aphids had spread over the entire western half of the state to the Nebraska line, but actual damage was confined largely to the southern and central counties. The green bugs continued to feed upon the developing heads, many of which were shortened, and failed to emerge fully. The greatest damage occurred in Stafford, Edwards, Reno, Seward, Pawnee, Ness, Rush, Ellis, Gove, and Trego Counties. In many fields, green bugs were more plentiful on oats than on wheat. The green bug was finally brought under control the latter part of May by parasites and lady beetles.

Aphids reported to be green bugs became plentiful on fall-sown wheat in the western half of the state during the fall. Three species were present in Riley County on wheat, but R. H. Painter failed to find the green bugs present. The apple grain aphid was the most plentiful, and the English grain aphid appeared to rank second in numbers. Some injury was done by these aphids to late-sown wheat.

Corn leaf aphids were observed by R. H. Painter to have been plentiful on corn. This observation was made while on a trip in early August to southwestern counties. These aphids were scored at 3 in Ellis County and 2 in Riley County.

Aphids on elms, spiraea, chrysanthemums, beans, melons and radishes were less plentiful than usual, and lower in numbers than in 1942. Lady

beetles, chrysopids and syrphus flies increased to effective numbers early enough to prevent injuries by those species.

Elm leaf aphids were scarce in 1943 and not a factor in any county in the health of elm trees. They were scored at 4 in Leavenworth County.

Other hosts mentioned in aphid reports were garden crops, especially radishes, melons, and cucumbers. They scored at 5 in Pawnee and Decatur Counties; at 4 in 13 counties; at 3 in 12 counties and at 2 in 7 counties. On apple they scored at 4 in Jefferson and Doniphan Counties; on shade trees, particularly elms, at 4 in Leavenworth County; and on chrysanthemums at 2 from Riley and Doniphan Counties.

Army worms were reported widely over the state in early summer, but heavy rains either prevented injuries or hastened recovery in plants. The numbers present were normal, but damage was less than normal, and lower than in 1942.

Evergreen bag worms probably were slightly more numerous and destructive in the eastern half of the state in 1943 than in the previous year. They were observed in nurseries fully as frequently as usual, and the number of inquiries about the species was slightly above average.

The bean leaf beetle was reported in Riley County by H. R. Bryson to have been numerous and destructive to bean foliage during late summer. In the eastern and southeastern counties, the bean beetle destroyed entire plantings. It was abundant in Cherokee, Labette, Crawford and Johnson Counties. Cryolite dust was an effective control.

Bedbugs were somewhat more plentiful than usual, both in homes and chicken houses. War workers shifting locations frequently, and the large increase in poultry are believed primarily responsible for the increase in bedbug infestation.

Bees did well in Kansas in 1943. The Division of Statistics of Kansas estimated honey production from 44,000 colonies of bees at 1,672,000 pounds of honey compared with 1,400,000 pounds in 1942. The average production per colony was 38 pounds compared with 35 pounds in 1942, and 51 in 1941. The cool, late spring and heavy rains in early June hindered early activity, and the honey flow of sweet clover was cut off sharply near the end of July by the hot, dry weather. There was a small smartweed nectar flow in some areas in August and September. The demand for honey was the greatest for many years. There was little swarming during 1943.

Leaf cutter bees damaged foliage of roses and young ash leaves more commonly than usual. They were unusually abundant in Ford and Edwards Counties.

The bean weevil, *Acanthoscelides obtectus* (Say) was observed in Riley County by H. R. Bryson in considerable numbers on flowers, especially tiger and regal lilies, during early July. They ate the pollen but did not damage the flowers. They were readily brought into homes on bouquets.

Blister beetles were fairly plentiful during July and August in the western

half of the state and did some injury. Although widely reported from all over the state, actually they were less numerous and destructive than in 1942. Geo. A. Dean observed both the striped and gray species eating alfalfa blossoms, seed pods and foliage in Thomas, Cheyenne, Sherman, Rawlins and Decatur Counties in mid-July. They were less destructive to garden crops than usual.

Horse bot flies were widely reported in the state and probably were somewhat more numerous in 1943 than in 1942. County agents reported that veterinarians treated 13,769 animals for 3,025 farmers in 1943.

The **sheep bot fly** continues common and, since the numbers of sheep in the state have increased, it is believed this pest has increased in numbers correspondingly. The flies were observed laying eggs April 30th and infested sheep were seen in May.

Borers in trees of various kinds were widely reported but the scores indicated they were less destructive in 1943 and far below the peak of the drought years. They apparently were most destructive in southeastern counties. Elms were mentioned as the chief hosts in 19 counties; apple plum and cherry trees in 7 eastern counties; peach in 11 counties; honey locust, black locust and maple trees were noticeably attacked by borers in 1 to 3 counties for each.

Box elder bugs were no more plentiful than in 1943. A relatively small number of adults went into hibernation in the autumn and they caused little annoyance in and around homes.

Cankerworms were less numerous than in 1942. Isolated trees outside of cities had severe foliage injury. A few moths emerged early in January but cold weather near the middle of the month stopped the emergence. The fall cankerworm moths reached a peak about February 22 in Riley County. The spring cankerworm moths emerged in February and reached a peak in early March.

Most injury was reported in the eastern fourth of the state, especially southeastern counties but considerable numbers occurred in scattered western counties. Several reported damage to Chinese elms but, in general, elms in the country were chiefly attacked.

Cabbage worms were widely reported in the state in 1943 but numbers and damage were no more than occurred in 1942.

Carrot beetles were present in normal numbers in 1942. They were observed in gardens in June over most of central Kansas. They were scored at 5 for Stevens County by F. L. Timmons.

Carrot weevil. This small weevil was found in many gardens in eastern Kansas. The entire planting was destroyed in the vicinity of Lenexa in Johnson County. It appears to be spreading westward since it was found in Shawnee and Osage Counties last year.

Cattle grubs occurred perhaps in normal numbers in 1943, but the eradication of these cattle pests was strongly stressed in extension work with ap-

parently good results. These campaigns were considered a major contribution to the war effort. Early reports of cattle running from the flies were received the latter part of April. Grubs were reported infesting chiefly southern cattle brought in for pasture.

The northern cattle grub was thought to have been present only in Cheyenne County.

There were 116,000 head of cattle treated with derris during the winter 1942-43 in 91 counties in Kansas.

Calligrapha scalaris Lec. was reported as causing marked defoliation of elms from April to late summer at Miltonvale and Manhattan. This species was somewhat more plentiful than usual in the state.

Chinch bugs were lower in numbers in 1942, and below normal in numbers during 1943. There were good reasons for expecting large numbers of these insects in 1943 with marked damage in the western half of the state but, by May 12, they were actually scarce. Eight adults to a foot of wheat row at Oak Hill, Clay County, was the maximum number seen. The weather continued unfavorable and they did not increase to threatening numbers. No barriers were built and the small number of bugs going into hibernation made fall control measures unnecessary. A little damage was done to some corn along U.S. highway No. 75 and around Wichita. The drouth accentuated the small amount of damage.

A. L. Hallsted reported a few chinch bugs as far west as Hays but, in general, they were scarce beyond a line connecting Ottawa and Sumner Counties.

A considerable population of chinch bugs went into hibernation in the fall from corn and sorghum.

Clover leaf weevil larvae were found readily in most clover and alfalfa fields in early April, but the numbers remained small and the species was of no consequence. Crows were reported feeding upon them in the fields.

Clover seed chalcid did some damage to alfalfa seed in south-central Kansas counties, according to Geo. A. Dean.

Codling moths were exceptionally numerous and destructive during 1943. A normal population of codling moth larvae attacked a half crop of apples with the result that an abnormally high percentage of wormy apples was harvested. Growers thought the crop too poor to protect by sprays up to July, so neglected the early sprays. They then began applying the cover sprays, but with poor results. The low grade, small, wormy crop of apples, however, was sold readily at a higher price than for many years.

It was found while scraping the bark from apple trees in November for codling moth control that an abnormally large population was overwintering under the bark. Erwin Abmeyer reported 115 on one tree and predicted that some trees had 200 overwintering larvae.

Colorado potato beetles continued in small and inconsequential numbers, except in Victory gardens, in 1943. They were destructive in a few gardens

up to June 10th but for the season they were below normal in numbers and of no consequence in commercial plantings. The cool, damp, cloudy weather of May apparently proved unfavorable to the eggs and young larvae. Many eggs appeared to be infertile.

Columbine leaf miner was more plentiful than for several years.

The **corn earworm** during 1943 was distinctly below normal in numbers and less than last year. Damage to sweet corn, field corn, alfalfa and sorghum heads was less than usual. The species, however, was widely reported, but the scorings were mostly 1 to 3, with no 5's.

Cotton leafworm moths were less common than last year and below average in numbers in 1943. They were scored at 4 in Thomas County by J. B. Kuska; 2 in Ellis, Rice, McPherson, Cowley and Lyon Counties, and at 1 in Riley and Gray Counties.

The **cowpea curculio** (*Chalcodermus aeneus* Bob.) was observed near Hutchinson during May eating the leaves and stems of cabbage. Damage to young cabbage plants by this insect is unusual.

Crambid moths appeared in Riley County in large numbers at lights during the first week of October. They were common in grass during the late summer and fall.

Crickets invaded some homes during the summer, but this was less common than usual. They occurred in large numbers in the extreme western counties, and they did some damage to parachutes at flying school camps, particularly in Ellis County.

Cutworms were found in greater numbers than in 1942 but still were below normal. **Army cutworms** were distributed widely over the state in alfalfa fields in early April, but only slight injury was done. One larva to the square foot was about the largest number seen.

Garden species of cutworms, however, were of much greater importance. Many gardens had rather severe cutworm injury up to May 1. P. G. Lamerson reported the garden species as more numerous and destructive in northeast Kansas than last year. Young cabbage and head lettuce plants particularly were damaged by them. They were reported damaging gardens in 65 counties during the spring. Other crops mentioned by reporters were corn in 18 counties, wheat and oats in 4 western counties, and alfalfa in 5 central and western counties.

Yellow striped armyworms probably were slightly more plentiful than in 1942. They damaged soybean foliage during July and August.

Pale western cutworms were not reported for Kansas in 1943. A. L. Hallsted stated that there was a possibility that this insect may have been responsible for some destruction of wheat plants being cut off below ground, but the cutworms were not discovered. The 3 scoring in Thomas County by E. O. Graper may have been based on this same condition.

Datanas on apple, cherry and sumac were unusually plentiful and did serious foliage injury to some trees in late summer.

The **eight spotted forester** larva was more plentiful than usual on the foliage of grape and virginia creeper in early summer than last year. Mr. Wenger reported this species as causing noticeable defoliation at Tribune, Elkhart, Dodge City, and many other places in western Kansas.

False chinch bugs were exceptionally plentiful in many central and western counties on wheat, alfalfa and shepherd's purse during early June. The latter plants were killed by them along paths and ends of rows. They were more abundant than for many years.

False wireworms were less plentiful than normal in western Kansas in 1943. They were most noticed in the dry areas but they caused no serious damage.

The **fall armyworm** was reported widely but numbers were comparable to those of 1942.

Fleas on pets and in homes were common but normal in numbers in 1943.

Flea beetles were more numerous and destructive to early gardens in the spring than in 1942. They were scored at 4 for Doniphan County by P. G. Lamerson, and 3 for Riley and Pawnee Counties. They attacked particularly tomatoes, potatoes, egg plant and radishes.

Flies of several species developed to abnormally large numbers in 1943 as a response to favorable weather conditions during the spring and early summer.

Screw worm flies occurred in a medium outbreak in Kansas during 1943. Weather conditions were favorable for them and they became abnormally plentiful throughout many of the southern states. The flies appeared early in Kansas, and infestations reached a peak of abundance early in July, but continued to be a major stock problem until October. This livestock pest spread over a larger area in the southern and central parts of the United States in 1943 than was ever known before, according to E. W. Laake of the Bureau of Entomology and Plant Quarantine. He classified the outbreak in Kansas as medium or light on a computation of not over 2 percent of livestock attacked.

Screwworms were observed to have been particularly damaging in Cowley, Elk, Chautauqua, Butler, Greenwood, Woodson, Montgomery, Douglas and Doniphan Counties. They were reported as especially abundant in the vicinities of Leavenworth, St. Joseph and Kansas City. In Riley County the outbreak appeared to begin later than usual, and to continue later in the fall. Lester Brock found evidence of them in every county along the southern border of Kansas by the middle of July, and in the western part of Kearny and the eastern parts of Pratt and Kiowa Counties. He stated the percentage of infested cattle was particularly high. They attacked small calves and pigs also. Attacks on sheep and lambs ranked next to cattle in the state, but horses also were mentioned. Farmers treated 42,000 animals for screwworms in 1943.

The **black blowfly** (*Phormia regina*) attacked sheep in western Kansas during the spring of 1943. For the year, the number appeared to be somewhat less than last year.

Stable and horn flies probably were more abundant than last year and population peaks occurred following the rains in June and September. They were reported widely over the state and the score numbers indicated more than average annoyance from them.

Horse flies, especially *Tabanus sulcifrons*, were exceptionally plentiful near streams in southeastern Kansas counties in June and July. The heavy early summer rains and floods greatly favored these pests of domestic animals. They were scored at 3 in Brown, Cowley, Butler and Doniphan Counties, and at 2 for Johnson County.

Garden webworms occurred in mild, scattered outbreaks in 1943. They were reported widely in the state, and important damage was done in many counties in the eastern half of the state. The third cutting of alfalfa particularly was attacked, but garden and corn also were damaged. Soybeans were damaged seriously in many southeastern counties. This is the first report received of damage to the leaves of young soybean plants in Kansas. The moths were plentiful, particularly during August.

These insects developed into a small, irregular outbreak in some alfalfa fields in Riley County the latter part of July. The hot, dry, weather in Riley County apparently was so unfavorable to them and to the eggs that larvae were scarce after mid-August.

While most reports of the webworms were based on damage to alfalfa, they also were reported on sweet potatoes, corn, cane and sorghum. They were particularly destructive to late plantings of these crops.

The **grape leaf folder**, *Desmia funeralis* (Hbn.) was scored at 5 by P. G. Lamerson in Doniphan County.

Grasshoppers were slightly below normal in population during 1943 and damage was confined to a few counties in the western part of the state. The eggs hatched late, and the cold, wet spring caused high mortality. Grasshoppers appeared during July and August to be building up all over the state, especially in the eastern half. However, they did not require control operations in eastern Kansas. By the end of July, the two-lined and differential species were abundant and doing damage to alfalfa in Thomas, Cheyenne, Sherman, Rawlins and Decatur Counties. Weeds in wheat fields supplied the grasshoppers with food, and they moved out of stubble land slowly. The second cutting of alfalfa during the last of July was damaged by them in the Arkansas River Valley. They ate the blossoms and leaves from many acres of alfalfa. Damage over the state was confined largely to feeding at the borders of fields and to some gardens.

During the fall, the two species mentioned and the American grasshoppers were plentiful in patches of soybeans and cowpeas in Riley County. They ate into the pods, as well as doing some foliage injury.

The second generation of the migratory grasshoppers was large in many western counties.

Grasshoppers were most numerous and destructive during 1943 in Cheyenne, Rawlins, Sherman, Thomas, Wallace, Logan, Greeley, Wichita, Scott and Hamilton Counties.

Poison bait was required in several counties for small areas. It is notable that only 937 farmers put out not more than 232 tons of bait during the season.

The fall egg survey showed that the areas adjoining Cheyenne, Sherman, Thomas and Rawlins, Kearny, Finney, Wichita and Scott Counties had the largest deposition of eggs in the soil in the state.

Green-striped maple worms defoliated maple trees in Jackson and Jefferson Counties were reported by R. L. Parker. They were scored at 3 for Doniphan County by P. G. Lamerson.

The **hessian fly** was the most destructive insect of 1943 in Kansas. The weather favored this insect and the reduction in the wheat crop from this cause has been estimated at 25,000,000 bushels.

Rains April 7 to 9 brought out the adults in eastern Kansas, and egg deposition was heavy. Many thin stands of wheat were due to plants killed before and during the winter from hessian fly attack. Many fields from Marshall and Washington to Sumner Counties showed severe hessian fly damage in mid-May. As many as 80 to 90 percent of dead plants in some fields contained **flaxseeds** with as many as 50 percent of the tillers infested.

The hessian fly moved westward, the western border of injury being the tier of counties from Jewell to Harper Counties, while the triangular area Miami to Elk and Chautauqua Counties had a light infestation. R. H. Painter reported that there was only a single spring brood and practically no summer brood due to the small amount of volunteer wheat. This was the result of the hot, dry weather during July, August and early September.

The counties enclosed by a line connecting Riley, Reno, Sumner, Lyons and Wabaunsee Counties had the highest hessian fly infestation and suffered the greatest wheat loss. However, the northeastern counties from Nemaha to Wyandotte had only a little lower infestation and loss.

The hessian fly survey at harvest time in Kansas by representatives of the Bureau of Entomology and Plant Quarantine⁷ included the following data:

TABLE IV. Harvest time hessian fly survey by representatives of the Bureau of Entomology and Plant Quarantine.

	Number fields sampled	Average Percent	Stems infested	
			Maximum Percent	Minimum Percent
Western counties.....	63	1.7	30	0
North central counties.....	84	9.2	46	0
South central counties.....	57	2.1	46	0
Northeastern counties.....	99	12.1	74	0
Southeastern counties.....	57	3.5	30	0

⁷ Cartwright, W. B. Hessian fly survey at harvest time 1943. Insect Pest Survey special supplement. 3 p. Sept. 15, 1943.

The 12.1 percent stem infestation was the highest report in the United States except 13 percent for New Jersey. The median infestation in the Great Plains states was about 5 percent.

The fall brood of hessian fly adults appeared a little later than usual in 1943 but the safe planting date schedules were satisfactory. Much wheat in the hessian fly areas was planted before the safe date and, in general, it was heavily infested.

Leafhoppers attained usual numbers on grape, woodbine, and spiraea bushes during September and October. The potato leafhopper was somewhat more plentiful than usual. This species did marked injury to a small field of alfalfa in Riley County in July. They migrated in from weeds, especially near by "mare's tail." Swarms of this species were noted when potatoes were dug in Kaw Valley fields. There was a heavy flight of leafhoppers and other insects the nights of September 7 and 8.

Leafhoppers were reported on the following plants or crops: Potatoes, scored at 4, in Cowley, Wyandotte and Riley Counties; at 3 from Rice and Neosho Counties, and 1 in three counties; on alfalfa at 4 from Kearny and Riley Counties, and three counties at 2; on wheat or rye at 4 from Kearny, Rush and Sedgwick Counties; on garden crops especially beans, beets, egg plant, cucumbers and melons at 5 in Leavenworth County, at 4 in five counties, at 3 in 11 counties, at 2 in 4 counties and at 1 in four counties; on grapes and woodbine at 4 in Riley and Cowley Counties, at 3 in three counties, at 2 in two counties; on apple at 3 in Morris and Doniphan, and at 2 in Jefferson Counties; on elms at 4 in Douglas, and 2 in Riley Counties and on buffalo grass at 2 in Ellis County.

Cattle lice were more abundant and destructive in 1943 than the previous year. Sucking lice alone caused marked unthriftiness and some deaths. Some dipping vats are now in use. The cube-wettable sulphur dusts and dips gave good control results.

Hog lice were plentiful in 1943, but the infestation and injuries were normal.

Mites, excepting hog mange mites, were less numerous than in 1942 and during previous years.

Chiggers occurred in fair numbers during June but for the year were well below 1942. They were average in numbers or probably somewhat below normal except in the Kaw Valley and southeastern Kansas counties.

Clover mites caused annoyance in homes around Garden City in early April, but were sent to the Department of Entomology, Kansas State College for identification from perhaps a dozen addresses during early spring and late fall.

The **tropical rat mite**, *Liponyssus bacoti* (Hirst) was sent from an infested house in Topeka during the summer and identified by H. E. Ewing, Bureau of Entomology and Plant Quarantine. This and the report by Hungerford (Jour. Kan. Ent. Soc. 16(4)154, 1943) constitute the first authentic reports of

this mite in Kansas. This mite is now spread over most of the United States where it lives in rat nests and sometimes causes great annoyances in homes, stores, offices and factories.

Hog mange mites were particularly abundant during the winter and spring of 1942-43. More hogs were treated for this pest in 1943 than for many years. In 74 counties 9,603 farmers treated 174,014 hogs with lime-sulphur dip.

Red Spider mites were less numerous than usual in 1943. They occurred in greenhouses and on many evergreens in nurseries during the summer. Little damage was done outdoors. By the end of July, they declined rapidly in numbers, as is usually the case, but the typical salmon color of injured elms was observed during August. These mites scored at 3 in Doniphan, Wyandotte, Neosho, Wilson, Riley, Ellis, Pratt, and Meade Counties; at 2 in 10 widely scattered counties and at 1 in two counties.

The **sheep scab mite** occurred in several flocks in southeastern counties. Most of these flocks were dipped under direction of the State Livestock Sanitary Commissioner.

The **spinose ear tick** occurred moderately in some cattle herds during October. For the year, they were less numerous and annoying than last year, or normally.

The **brown dog tick** continued to be the tick most commonly reported by the public. Many dogs were attacked and some houses were known to become infested with them.

The **lone star tick** was found by Missouri entomologists to have been the most numerous species of tick in that state in 1943. It is probable that this was the species of tick reported plentiful on cattle in eastern and southern counties also.

The **redbud leafroller** was scored at 1 for Riley County, indicating below 1942 and normal numbers by R. L. Parker.

Rose sawflies were comparable in numbers and damage to 1942. There was some damage done, but favorable growing conditions for roses rendered their attacks of little consequence. They were scored at 4 in Neosho; 3 in Wilson, Cowley, Doniphan, Wyandotte and Ellis Counties; at 2 in 11 eastern and central counties, and at 1 in 10 other counties.

The **potato stalk borer**, *Trichobaris trinotata* (Say) was scored at 3 by Backus for Wyandotte County, where it attacked tomatoes and potatoes.

Scale insects of various species were scarce in 1943. The **red cedar scale** was scored at 3 in Neosho, Harvey and Morris Counties, and at 1 for Kiowa and Riley Counties. Scales on "fruit trees" were scored at 3 for Wyandotte, Doniphan, Labette and Cherokee Counties.

Sheep ticks were scored at 3 in Lyon County by J. E. Taylor. County agents reported that 3,500 growers in 84 counties dipped 214,847 sheep and lambs for ticks in 1943. Lamb feeders dip the lambs upon arrival from western states.

Stored grain insects were approximately as plentiful in 1943 as during the previous year. They were widely and extensively reported in the questionnaires, generally with the notation that wheat was the grain attacked. R. T. Cotton reported that the lesser grain borer appeared to be more widely distributed in farm stored grain, particularly in the southern half of the state, than in previous years. County agents reported that 14,822 farmers in 92 counties fumigated wheat in farm bins.

The **strawberry rootworm**, *Paria canella* (Fab.) was scored at 4 in Doniphan County by P. G. Lamerson.

The **strawberry leafroller** was scored at 3 by P. G. Lamerson for Doniphan County which would indicate a normal population and equal to 1942.

Squash bugs were abundant and destructive in Riley, Cowley, Sedgwick, Reno and many other counties. Actually this insect and the next prevented a crop of squashes and pumpkins in many gardens.

The **squash vine borer** was observed by H. R. Bryson to have been more destructive than last year.

The **oriental fruit moth** was found in 25 additional counties of Kansas during a special co-operative survey by representatives of the Bureau of Entomology and Plant Quarantine and state inspectors. It was known previously to occur in 27 eastern counties. The map prepared by T. D. Persons, Bureau of Entomology and Plant Quarantine (See unnumbered mimeographed report entitled "The 1943 oriental fruit moth survey." p. 19) indicates the presence of this fruit pest in all counties, except Cloud, east of a line connecting Republic and Harper Counties. Moths were trapped in Ford County also.

Phenacoccus solani (Ck11.) a mealy bug was sent in from Wichita on red warba potato sprouts. This is a first report for the state. D. J. Caffey, Bureau of Entomology and Plant Quarantine, reported that it has been recorded on many weeds in California as well as potato and tomato.

The **Southwestern corn borer** increased somewhat in numbers and distribution during 1943. It was found in 29 counties in 1941; 22 more counties were added to the list in 1942,⁸ and 10 additional counties in 1943, namely: Dickinson, Logan, Sheridan, Smith, Thomas, Butler, Chautauqua, Montgomery, Elk and Cowley. This corn borer is now as far east as Clay and Marion Counties in the north and Montgomery County in the south. It has reached the Nebraska line in Norton, Smith and Phillips Counties. Corn in Harper, Kingman, Barber, Pratt, Pawnee and Stafford Counties frequently was 80 to 100 percent infested by these borers, and 20 to 90 percent of these stalks had broken over by husking time. There were more 100 percent fields than ever before.

The increase in numbers was particularly noticeable in the first generation borers and a greater amount of "dead heart" injury resulted than has previously been observed in this state. For reasons unknown, girdling of the stalk, prior to corn harvesting was more prevalent, and resulted in a large increase in fallen stalks over the 1942 season.

Pine sawflies did noticeable damage to some pine and arbor vitae trees in Riley County during early June.

Rose sawflies were slightly more plentiful and destructive to rose foliage in 1943 than in 1942.

Tomato hornworms were equal in numbers to 1942. The chief tomato problem in 1943 was a disease, not insects, which caused the fruit to rot.

Termites were reported widely in the state but numbers and damage were no more than last year nor than usual. The counties reporting tend to lie in one of the river valleys of the state.

Walnut worms were below 1942 and below normal in numbers in the state in 1943.

Wheat strawworms were rather widely reported in the state in 1943. In numbers and damage they probably equalled 1942.

White grubs did somewhat more damage to potatoes and gardens in 1943 than in the previous year.

Wheat white grub adults were not plentiful in 1943 as this was the year for the larvae to appear in the two-year life cycle. Many wheat fields in southern and western Kansas were damaged by the larvae. A. L. Hallsted said he had never seen them so numerous. Fields were seen where there were as many as three grubs to the foot or drill row. Reports of white grub injury to wheat, necessitating re-drilling in part or all, probably were due to this species. Early sown wheat in McPherson, Stafford, Pawnee, Edwards, Rush, Barton, Rice and Harvey Counties were attacked by wheat white grubs, but only thinning of stands resulted. The grubs appeared in far western counties for the first time. Many fields were damaged in Wallace, Logan, Sherman, Rawlins and Thomas Counties.

Wireworms were not particularly plentiful in 1943 and probably were below 1942 in numbers. They were reported feeding on potatoes in 7 eastern counties; on corn in 13 eastern counties, and on tomatoes and other garden crops in 5 counties.

SUMMARY AND CONCLUSIONS

Temperature and Moisture

The year 1943 was near normal in temperature or slightly cooler and above normal in rainfall. It was a year of good crops and a pleasant year generally. December was slightly above normal in temperature and below normal in moisture. February was 7° above normal in temperature and below normal in moisture. The early spring was abnormally cool. The rainfall in May and June was well above normal and disastrous floods occurred along many streams. Precipitation from July to December was below normal. The soil in central and western counties was too dry for good wheat growth. Temperature conditions from September to mid December were exceptionally pleasant and the first killing frost came after crops were mature.

Insect Occurrence

Outbreak numbers: pea aphids, green bugs, screwworm flies; garden webworm, and hessian fly.

More numerous than in 1942: alfalfa plant bug, apple grain aphid, bagworms, bean leaf beetle, carrot weevil, bedbugs, leaf cutter bees, horse bots, sheep bot, cattle grubs, cattle lice, codling moth, garden species of cutworms, yellow striped armyworm, *Datanas*, eight spotted forester moth, false chinch bugs, garden flea beetles, house flies, horse flies, stable and horn flies, certain leafhoppers, swine mange mites, squash bugs, squash borers, oriental fruit moth, Southwestern corn borer, wheat and garden species of white grubs.

As plentiful as in 1942: house and lawn ants, corn leaf aphids, armyworms box elder bugs, carrot beetles, cabbage worms, Colorado potato beetles, army cutworms, fall armyworms, fleas in homes, rose sawflies, stored grain insects, tomato hornworms, termites, wheat strawworms and wireworms.

Less plentiful than in 1942: elm and garden species of aphids, borers in trees, blister beetles, cankerworms, chinch bugs, clover seed chalcids, corn earworms, cotton leafworm moths, black crickets, false wireworms, black blowflies, grasshoppers, red cedar scale, chiggers, red spider mites, spinose ear ticks, redbud leafroller, walnut worms and wheat white grubs.

Scarce: clover leaf weevil and clover mite.

THE ROLE OF SORPTION IN THE FUMIGATION OF STORED GRAIN AND MILLED CEREAL PRODUCTS

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It has long been recognized that the fumigation of stored grain and milled cereal products is complicated to a greater or less degree by the factor of sorption. Concentrations of most gases that kill insects in an otherwise empty container and with a given exposure period have little or no effect on the insects in a similar period if the container is filled with materials such as grain or flour. Very much higher concentrations are required to compensate for the fumigant sorbed by the material. Methyl bromide is an exception in that only a slight increase in dosage is required for the fumigation of a container when it is filled with milled cereal products.

Experience has shown that advantage can be taken of the capacity of cereal products for sorbing fumigants. The Law of Haber, that the toxic action of a fumigant is proportional to the degree of the concentration and the length of the exposure, holds in the fumigation of these products, and the vapors sorbed by them can be utilized to extend the period of fumigation until a satisfactory kill is obtained.

In experimental work on vacuum fumigation, 500 pounds of flour in 24-pound cloth bags were fumigated for 30 minutes with a dosage of liquid hydrocyanic acid (8 oz.), which had been established as the correct dosage¹ for a 3-hour exposure for that quantity of flour. Adults of the confused flour beetle, *Tribolium confusum* Duv., buried in the middle of the bags of flour were all alive when removed immediately after the fumigation. Others left in the flour for 48 hours, however, showed a mortality of 83.4 percent due to the action of the sorbed gas.

Diffusion of hydrocyanic acid through bags of flour is not obtained as quickly under atmospheric conditions as it is in a vacuum, but the gas absorbed in an overnight fumigation is retained and exerts a lethal effect for a considerable period of time after the flour is removed from the fumigating chamber. This is indicated by the data of Table 1, in which are recorded the results of the experimental fumigation of three lots of flour with liquid hydrocyanic acid in a concrete vault of 1,145 cubic feet capacity. Several lots of flour-beetle adults that had been buried in bags of flour before the fumigation were removed and examined when the flour was taken out of the vault, whereas others were removed 48 hours later.

TABLE 1—Effect of gas absorbed by flour on flour beetles left in flour bags 48 hours after removal from fumigation with hydrocyanic acid in a 1,145-cubic-foot concrete vault.

Amount of Flour in vault	Tempera- ture of Flour	Exposure Period	Dosage of Liquid HCN per—			Kill of Flour Beetles	
			Vault	1,000 cu. ft.	1,000 lbs. of flour	Immediately	
						after Fumigation	48 Hours Later
Pounds	°F	Hours	Pounds	Pounds	Pounds	Percent	Percent
8,000	88	18 2/3	1.5	1.3	0.18	41.6	66.6
6,000	88	15	2	1.75	0.33	36.6	95.0
8,000	82	20	2.5	2.2	0.31	58.3	100.0

In all cases the kill obtained 48 hours after the fumigation was very much greater than that immediately after the flour was removed from the vault. Balzer¹ in 1942 observed: "Rice readily absorbs hydrocyanic acid and very slowly liberates it on exposure to the air—a feature that is of considerable advantage, since the insecticidal effect persists for some time after the rice has been removed from the vault." In unpublished notes made available to the writers, he recorded that rice after fumigation for 15 minutes in a vacuum chamber with liquid hydrocyanic acid, at a dosage of 1¼ ounces per 1,000 pounds of rice, retained enough gas so that rice weevil adults removed from

¹ Balzer, A. I. Insect Pests of stored Rice and Their Control. U. S. Dept. Agr. Farmers' Bul. 1906:19. 1942

the rice 72 hours later showed a mortality of 99.4 percent, although weevils removed from the rice immediately after the 15-minute exposure were unaffected by the fumigant.

In recent work on the fumigation of wheat in tightly calked steel bins it has been found that fumigants are retained by the wheat for unusually long periods, with the result that the insecticidal action is extended much longer than would ordinarily be supposed. This long-time retention of fumigants was suspected when injury to the germination of wheat was sustained from dosages of fumigants known to be safe for ordinary exposure periods. In order to determine the length of the period that fumigants were retained in lethal concentrations in bins of wheat, lots of insects were inserted in the grain at weekly intervals after a bin had been fumigated, and exposed for 5 or 6 days to the vapors held by the grain. This procedure was continued as long as any insecticidal action from the retained fumigant was observed. The insects were exposed to the action of the fumigant by means of probes or "check sticks" composed of dowels 2 or 3 feet long, fastened together with perforated sheet-metal sleeves in such a manner that a small cell was formed at each union. A metal-cloth cylinder or a gelatin capsule with silk-cloth ends filled with wheat and insects was placed in each cell. The check sticks could be made of any length desired and were thrust vertically to the bottom of the bins so that insects would be exposed at from 2- to 3-foot intervals from the top to the bottom of the bins.

By this means it was determined that fumigants were retained in killing concentrations by the wheat for varying periods, depending on the gas used, the quantity applied, and the temperature of the grain. In general, the cooler the grain and the greater the volume of fumigant applied the longer it was retained. The 3-1 mixture of ethylene dichloride and carbon tetrachloride is usually applied in larger quantities than most grain fumigants and, as shown by the data of Table 2, may be retained in killing concentrations for as long as 4 months.

TABLE 2.—Retention of 3-1 mixture of ethylene dichloride and carbon tetrachloride in wheat in steel bins

Capacity of Bin	Date of Fumigation	Bins Fumigated	Dosage per M bu.	Average Mortality of Grain Insects after —		
				7 Weeks	12 Weeks	16 Weeks
Bushels		Number	Gallons	Percent	Percent	Percent
1,000.....	June 11	3	4-6	84	.....	.....
2,740.....	June 10	5	4-6	84	63	.....
2,740.....	Jan. 6	1	4	.....	.....	58
Check insects in untreated bins	.....	.....	.....	32	11	18

The long-time retention of this fumigant serves the very useful purpose of protecting bins of wheat from migrating insects during the critical period late in the summer and early in the fall, when grain temperatures are high enough to favor insect breeding. At Hutchinson, Kans., where experimental grain fumigation was carried on, the mean temperature of wheat stored in steel bins is ordinarily favorable for active insect development only during the summer months. At this period of the year, grain-infesting insects fly into the bins and may cause serious loss unless the proper methods of suppressing them are applied. By studying the rate of development of insect infestation in a number of calked steel bins receiving different treatments, it was learned that by fumigating the bins late in August with a 3-1 mixture of ethylene dichloride and carbon tetrachloride, developing infestations were stopped and sufficient fumigant was retained to protect the grain from migrating insects for the remainder of the warm weather. The natural cooling of the grain in the fall and winter protected it from damage until the following summer. Data regarding the development of insect infestation in wheat in calked steel bins, as affected by time of fumigation, are given in Table 3. The same dosage of fumigant was used in all these bins.

TABLE 3.—Development of insect infestation in calked steel bins of wheat, as affected by the time of fumigation with a mixture of ethylene dichloride and carbon tetrachloride, Hutchinson, Kans., 1943.

Number of Insects per 1,000-gram Sample ¹ on—											
Size of Bins	Date of Fumigation	Bins Observed	May 10	June 10	July 1	July 15	Aug. 1	Aug. 16-22	Sept. 3-16	Oct. 1	Oct. 25-30
Bushels		Number									
1,000.....	None	2	2	2	4	17	46	47	61	29	21
2,740.....	August	3	0	0	0	0	5	0	0	0	0
1,000.....	Aug.-Oct.	2	3	6	18	41	49	0	2	1	0
2,740.....	Sept.	3	1	1	3	5	14	28	39	0	0
1,000.....	Oct.	2	0	1	2	8	13	32	34	93	1
2,740.....	Oct.	3	0	1	1	2	9	11	13	....	1

Owing to this phenomenon of long-time retention of fumigants by wheat in steel bins, it has been found that fumigants formerly considered too low in toxicity to be of practical value can be used very successfully. Carbon tetrachloride, long used in admixture with flammable chemicals to reduce the fire hazard and with more toxic compounds to increase the volume and aid distribution, has been successfully used alone in calked steel bins at a dosage of 3 gallons per 1,000 bushels. At the end of a week's exposure a complete kill of all stages of grain-infesting insects has been obtained consistently.

¹ Average of 5 samples.

The tenacity with which wheat in steel bins retains the vapors of grain fumigants was demonstrated when a calked bin of wheat treated with carbon disulfide at the rate of 2 gallons per 1,000 bushels was transferred to another bin 3 days later. Check sticks containing capsules of grain heavily infested with insects were thrust into the grain the day after it has been transferred, so that insects were exposed at 2-foot intervals from the surface to the bot-

TABLE 4—Effect of fumigation with a mixture of ethylene dichloride and carbon tetrachloride, containing 10 percent of methyl bromide, on the viability of wheat stored in calked steel bins, Jamestown, N. Dak.

Bin	Percentage of Germination							
Capacity and No.	Aug. 1941	Feb. 1942	Aug. 1942	Nov. 1942	Feb. 1943	May 1943	Aug. 1943	Total Change
Fumigated Bins								
2,740 bu.								
R-1.....	94	92	65	36	24	20	16	—78
R-2.....	89	70	56	26	30	14	17	—72
S-1.....	92	72	60	44	44	32	30	—62
P-5.....	87	82	72	50	48	22	28	—59
Q-5.....	91	89	55	28	28	20	17	—74
R-5.....	93	84	61	53	51	38	17	—76
S-4.....	94	85	74	58	56	56	32	—62
Average...	91.4	82.0	63.3	42.1	40.1	28.9	22.4	—69
1,000 bu.								
G-5.....	90	90	84	70	73	60	42	—48
H-5.....	94	96	90	39	41	31	36	—58
Average...	92.0	93.0	87.0	54.5	57.0	45.5	39.0	—53
Unfumigated Bins								
2,740 bu.								
J-4.....	90	90	84	84	81	88	87	— 3
K-4.....	95	90	93	89	90	90	86	— 9
K-5.....	94	92	86	90	93	92	87	— 7
P-4.....	93	90	83	....	88	80	83	—10
Q-4.....	90	92	....	....	92	88	84	— 6
R-4.....	93	92	....	....	90	88	80	—13
S-3.....	93	87	79	....	88	86	80	—13
Averages...	92.6	90.4	85.0	87.7	88.9	87.4	83.8	— 8.6
1,000 bu.								
G-4.....	90	82	....	80	85	86	83	— 7
H-4.....	91	92	....	85	90	89	93	+ 2
Average...	90.5	87.0	....	82.5	87.5	87.5	88.0	— 2.5

tom of the central column of the grain. When the insects were removed 3 days later an average mortality of 99 percent throughout the bin had been obtained.

Unfortunately the long-time retention of certain fumigants causes injury to the germination of grain. At Jamestown, N. Dak., a series of nine calked steel bins of wheat has received three annual fumigations with a 3-1 mixture of ethylene dichloride and carbon tetrachloride containing 10 percent of methyl bromide. The first fumigation was given in November 1941, the second in August 1942, and the third in September 1943. An equal number of bins of the same type received no treatment during the entire period. The bins were filled in July 1941 and sand-bench germination tests were run for both series of bins at intervals of about 3 months thereafter. As shown by the data in Table 4, there was a decided decrease in the viability of the grain in the fumigated bins, from an average of 91.4 to an average of 22.4 percent in the 2,740-bushel bins, and from an average of 92.0 to an average of 39.0 percent in the 1,000-bushel bins. The data also show that the decrease in viability was not so rapid in the 1,000-bushel bins as in the larger ones, even though all the bins received the same dosage of 2 gallons of the fumigant per 1,000 bushels. This difference is doubtless due to the fact that the fumigant was retained longer in the larger bins. In the series of bins that received no fumigation, the germination decreased from an average of 92.6 percent to an average of 84.0 percent in the 2,740-bushel bins, and from an average of 90.5 percent to 88.0 percent in the 1,000-bushel bins.

Germination injury has also been observed with mixtures containing carbon disulfide, chloropicrin and 1, 1-dichloro-1-nitro-ethane and with carbon tetrachloride alone. The 3-1 mixture of ethylene dichloride and carbon tetrachloride is the only fumigant tested that appears to have little if any effect on germination, regardless of the length of the period it is retained or the number of times it is applied.

Corn in uncalked steel bins does not appear to retain fumigants for long periods. This may be due to the greater leakage factor in such bins and in part to the lower sorptive capacity of corn and to the greater air space between the kernels. Germination tests of shelled corn after fumigation have not shown any loss in viability due to the retention of fumigants.

Data available at the present time indicate that in spite of a considerable loss in viability of wheat due to fumigation, little consistent damage results to the baking qualities of flour made from such wheat.

A NEW PSEUDATRICHIA FROM BRAZIL

(Omphralidae-Scenopinidae)

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This is the only species of *Pseudatrichia* known to the writer from the New World, south of Mexico. With the exception of one Australian species, *P. mariaensis* Hardy, the genus is known only from Nearctic America and Mexico. *Pseudatrichia chilensis* Krober¹ was found to belong to a new genus and Krober has named it *Heteromphrale*.²

Pseudatrichia punctulata n. sp.

This species appears more closely related to *longurio* (Loew) but is readily distinguished by the square tipped, robust third antennal segment, the elongated head, narrowly separated eyes and the short R_4 in the wing.

Male.—Chiefly metallic blue black species. **Head:** Distinctly longer than high from side view, eyes oval (fig. a). Front polished, silvery just above the antennae; face greatly sunken in, thinly silvery pubescent. Lower portion of occiput polished black, upper part opaque gray. Eyes narrowly separated on the front, front at middle narrower than the median ocellus. Antennae dull black, first two segments with a few weak bristles; third segment about twice as long as first two, sparsely pale haired and square at tip (fig. b). **Thorax:** Minutely punctulated on the dorsum, with very fine appressed pubescence. Humeri and pleurae smooth and without pubescence. Halteres chiefly black, apices of knobs very faintly whitish. Thorax scarcely over one-fourth as long as abdomen and less than half the wing length. **Legs:** Coxae and trochanters yellowish. Femora chiefly black, bases of first two pairs slightly yellow. Tibiae and tarsi chiefly yellow, bases of tibiae and the apical two tarsal subsegments blackish. **Wings:** Faintly fumose and iridescent, the costal and subcostal cells are brownish. Vein R_4 at or but slightly beyond the middle of cell R_{5+6} , and R_4 is about equal in length to the section of R_{4+5} from r-m crossvein to furcation, or from r-m to its base. Crossvein r-m situated at about its own length from apex of discal cell (fig. c). **Abdomen:** Eight times as long as its greatest width, completely covered with minute punctules. Hypopygium longer than seventh abdominal segment, narrowed basally and rather bulbous in the median portion; terminal structures not well developed (fig. d). Entire hypopygium rather thickly covered with short yellow hairs.

Length: body, 6.6-7.3 mm.; wings, 3.7-3.9 mm.

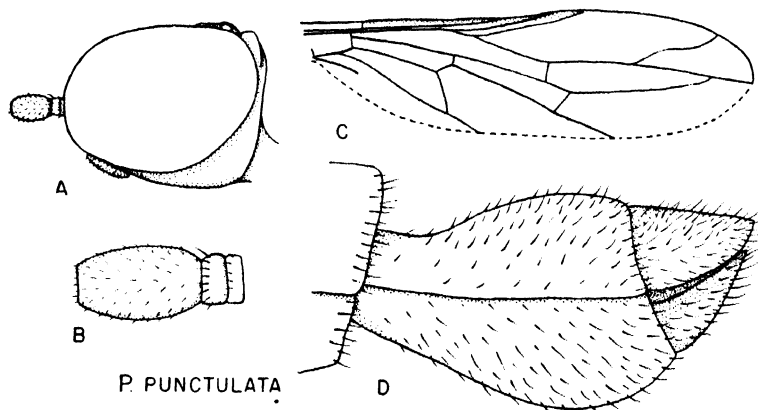
¹ 1932, Dipt. Patag. and S. Chile, Pt. 5, pp. 258-260.

² 1937, Stett. Ent. Ztg. 98, p. 213.

Female.—Front slightly narrower than the width of the ocellar triangle, with two rows of weak frontal hairs. Third antennal segment more distinctly pointed at apex above and below. Upper portion of occiput more strongly swollen and genital portion of abdomen with more dense, longer yellow hairs; otherwise like the male.

Length: body, 7.5-8.3 mm.; wings, 4-4.3 mm.

Holotype male: Brasilien Nova Teutonia, 27° 11' S. 52° 23' L., 20/11/1940 (Fritz Plaumann). Allotype female and two paratypes, a male and a female, same data. All types in Snow Entomological Collections.



EXPLANATION OF DRAWINGS

Pseudatrichia punctulata n. sp. a. head of male, lateral view; b. antenna; c. wing; d. male hypopygium, lateral view.

THE BIONOMICS OF *SCHISTOCERCA OBSCURA* (FABR)

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During the recent grasshopper outbreak in Oklahoma, one of the large so-called "bird grasshoppers," *Schistocerca obscura* (Fabr.), became unusually abundant and of minor economic importance. The occurrence of this species in fairly large numbers presented an unusual opportunity for obtaining much needed information on this interesting genus in North America.

S. obscura is a large grasshopper averaging from 34-40 mm. in length in the males and from 50-61 mm. in length in the females. In fresh specimens the general body color is dark olive green. Usually there is a narrow dorsal stripe of pale yellow color, which is conspicuous against the purplish-brown

color of the tegminae. According to Blatchley (1920) the structural characters are much the same as in *S. alutacea*, except that the pronotum has the median carina more sharply defined and slightly higher. The cerci of the males are somewhat narrower, with the outer apical third concave and the tips truncate.

The genus *Schistocerca* includes some of the most destructive grasshoppers in the world today. *S. gregaria* in Africa and *S. paranensis* in South America are agricultural pests of the first rank. These species are distinctly migratory and *gregaria* has been extensively studied with reference to its alternating "migratory" and "solitary" phases.

This paper deals with the life history and certain color changes brought about by varying the conditions under which the nymphs were reared. These color changes are believed to show a tendency for this species to assume a partial migratory phase. The work was done at Stillwater, Oklahoma, from June 1938 to July 1939. Except for the cases mentioned, the rearing was done in the Entomology Greenhouse of Oklahoma Agricultural Experiment Station.

GEOGRAPHIC DISTRIBUTION

Schistocerca obscura has a wide range of distribution. Scudder (1899) gives records from southeastern Colorado, New Mexico, and Central America. According to Blatchley (1920) its range extends south and west from Baltimore, Maryland, to Texas and New Mexico, and as far north as Iowa and Nebraska.

The earliest record in literature concerning the presence of this species in Oklahoma is that of Caudell (1902). Morse (1907) collected the species again five years later near Caddo, Okla. In 1927 Hubbell and Ortenburger give this record in their list of Orthoptera for the state. The latest reference to *Schistocerca* and *obscura* is that of Hebard (1938) in which he lists the species from Tulsa, Okmulgee, and Weatherford, Okla. The available records of the museum of the Department of Entomology, Oklahoma Agricultural and Mechanical College, show *obscura* to occur throughout the state. The largest population encountered during the course of the work was in Kiowa County, where this species caused considerable damage to wheat.

DESCRIPTION

Egg and Egg Pod—The egg pod when deposited has an elongate-cylindrical neck, slightly narrower than the rest of the pod. The entire length averages 47 mm, and the eggs are arranged in much less order than is the case with most of the other local species.

The egg when freshly deposited is elongate-cylindrical, slightly bent in the middle and tapering towards the ends. The posterior cap is broadly rounded at the end and the ring is not plainly evident. The surface of the chorion is sculptured with a definite pattern of slightly raised lines. The color is brick-red, but this becomes darker with age. The eggs average 6.37 mm. in length at the time of oviposition, but as the embryo matures the egg enlarges, and at the time of hatching reaches an average size of 6.78 mm.

The Intermediate Nymph.—Length 8.0 mm. being slightly larger than the first instar. The body is enclosed in a transparent, membranous sac which has extended pouches for the appendages. The head is bent downward, the antennae are close to the frontal region and the mouth parts hang continuous with their attachment to the cranium, not bent inward as in later stages. The genital segments are little developed, the cerci appear as conical extensions of the segment, the males have the ninth abdominal segment slightly notched on the posterior margin of its sternite. The two wing segments are distinguished by their lower posterior margins being rounded and slightly expanded.

First Instar.—Length 6.5 mm., color green. In the female the genital plate rudiments of the first valvulae appear as flattened lobes of the termination of the eighth sternite, which is considerably wider than ninth sternite; the second valvulae are not developed externally, and the third valvulae show conical processes which arise from the posterior part of the ninth sternite. The male genitalia are indicated by the expanded sub-genital plate with notched posterior margin and somewhat flattened cerci.

Second Instar.—Length of males 10.2 mm., of females 11 mm. Color green. The first valvulae are separated from the eighth abdominal sternite and extend to the anterior margin of the ninth sternite. The second valvulae are small and located between the bases of the third valvulae which show some sclerotization on the outer margins of their lobes. The sub-genital plate in the male is more expanded and the cerci are more flattened than in the first instar.

Third Instar.—Length of males 15 mm., of females 18.5 mm. Color green. Small wing pads appear with their ventral margins almost horizontal and with tegminal rudiments clearly differentiated from the rest of the prothorax so that only the tips of the tegminae are exposed. The rudiments of the ovipositor are further developed, the first valvulae nearly overlapping the second and tapering abruptly from the middle to the tips. The male genitalia are clearly distinguished by the swollen sub-genital plate, deeply notched at the end, and by the flattened cerci.

Fourth Instar.—Length of males 21 mm., of female 23 mm. Color green. The wing pads are upturned, approximately between the tips and covering the rudiments of the tegmina. The genital segments are similar to those of the adult but with less sclerotization, and the sub-genital plate of the male is not so upturned or expanded as in the adult.

Fifth Instar.—Length of males, 26 mm., of females 38.5 mm. The general color remains green, but the adult coloration of purplish-brown shows through the integument just before the final molt. Wing pads same as in preceding stage.

BIOLOGY

Food Habits.—With the exception of some specific experiments in host-plant preference, the principal food used in the rearing cages was American

elm. Other common plants were tested, but it soon became evident that *Schistocerca obscura* had decided preferences concerning its food. It was then planned to study these plants on basis of preference. Since the rearing was carried out in the greenhouse where humidity and temperature conditions were not normal it seemed likely that food consumption here would not indicate a normal outside preference, so food plant studies were done in cages outside of the greenhouse.

Four different species of plants were placed in three cages, each cage containing five individuals of each sex of *Schistocerca obscura* adults. The plants were replaced each morning with a series of four different species. At the end of each day's test, each plant was rated on a basis of from one to four for preference. When the entire group of 22 species of plants had been tested, those having the same rating were then tested against each other. For example cotton, elm, ash, persimmon and wheat were given the same rating on different days. They were then offered to the grasshoppers at the same time. The results of this experiment are shown in Table 1.

TABLE 1.—Food Plant Preferences of *Schistocerca obscura*
Stillwater, Oklahoma, 1938

Group 1 *	Group 2	Group 3	Group 4	Group 5
(Preferred)	(Readily Eaten)	(Less Readily Eaten)	(Eaten only when others not available)	(Not Eaten)
American elm (<i>Ulmus americanus</i>)	Green mature corn (<i>Zea mays</i>)	Alfalfa (<i>Medicago sativa</i>)	Ash (<i>Fraxinus</i> spp.)	Black Walnut (<i>Juglans nigra</i>)
Cotton (<i>Gossypium herbaceum</i>)	Persimmon (<i>Diospyros virginiana</i>)	Apple (<i>Pyrus malus</i>)	Black Locust (<i>Robinia pseudoacacia</i>)	Young corn (<i>Zea mays</i>)
	Wheat (<i>Triticum vulgare</i>)	Blackjack oak (<i>Quercus marilandica</i>)	Peach (<i>Prunus persica</i>)	Cottonwood (<i>Populus deltoides</i>)
		Hackberry (<i>Celtis occidentalis</i>)	Red bud (<i>Cercis canadensis</i>)	Mulberry (<i>Morus</i> spp.)
		Sumac (<i>Rhus</i> spp.)		Pecan (<i>Hicoria pecan</i>)
		Virginia creeper (<i>Parthenocissus quinquefolia</i>)		Soybean (<i>Glycine max</i>)
				Grasses (various genera)

* Plants most preferred in Group 1; those less preferred in order, left to right.

In the field, a more or less seasonal cycle of food plant preference was noticed. This cycle, which represents the probable feeding habits as a typical habitat for the species in this area, is as follows: The nymphs hatching in the spring feed on the leaves of the low scrubby elm growth until reaching maturity. On reaching the adult stage the insects move to other foods, although elm still occupies an important place in their food habits. In localities where corn and cotton fields are bordered with elm, the adults first move to the corn to feed; however, this occurred after the corn had reached a height of some five feet or better. No feeding on young corn was noticed either in the field or in the laboratory. Later when the corn is fully mature and commencing to dry out, the grasshoppers move to the cotton, where they may cause considerable damage by feeding on the leaves. Always, however, there is considerable movement between corn, cotton and elm trees. In the late fall young wheat may be attacked if the field is so situated as to be near a locality suitable for oviposition, since this species congregates at these places in the fall for depositing the eggs.

Copulation: The males of this species seem to be susceptible to sexual stimulation at a much earlier time after the last molt than are the females. Several males were seen attempting to copulate within a short time after the last molt and this was noticed to be particularly true when freshly molted males and females were placed together in the same cage.

With caged females, reared under laboratory conditions, the length of time from the date of the last molt to the first copulation was 18 days (Table 2). This may be sooner than with females living under natural conditions, as Pospelov (1934) concluded that caging females shortened the time required for reaching sexual maturity.

Oviposition: The typical habitat for oviposition usually consisted of a creek bordered with elm trees or low scrubby elm growth and a sandy soil. The eggs, as a rule, were found to be deposited in the soil around the bases of the young elm growth, particularly on the creek banks.

TABLE 2.—The Pre-Copulation Period of *Schistocerca obscura*—Females

Cage No.	Date of Last Molt	Date of Copulation	No. of days from last molt to first copulation
3	July 24	Aug. 8	16
6	July 23	Aug. 12	21
9	July 23	Aug. 4	13
7	July 23	Aug. 4	13
10	July 19	Aug. 16	29
15	July 21	Aug. 5	16
Average number of days			18

In general this species seems to bear out the observations on egg development made by Pospelov (1934) on the migratory locust in Russia. This writer found that females did not develop eggs in the ovaries until copulation had taken place. He states that fertilization is in itself a factor which permits the maturation of the eggs in the ovaries.

In following out Slifer's plan (1936) for securing eggs from unfertilized females, the author isolated five female adult *Schistocerca obscura* which had freshly molted. These were kept caged without males for a period of approximately two months, at which time dissection showed that three of the individuals had not developed eggs in their ovaries. One of these females was then placed with a male; copulation immediately took place and eventually one egg pod was deposited. On the death of this female about ten days after the egg pod was deposited, dissection showed another batch of well developed eggs.

Actual oviposition was observed in two cases in the laboratory with the aid of specially prepared oviposition cages. These consisted of glass jars filled with sand, the surface of which was covered with cardboard with the exception of a small margin around the edge. A female ovipositing could easily be seen through the side of the jar. The time required for oviposition averaged approximately 30 minutes. The bottom of the egg mass was inserted to a depth of about ten centimeters in the soil and the top was capped with a mass of froth which extended to just below the surface of the ground. The eggs were glued together with the mucilaginous secretion of the female and particles of soil adhered to the outer surface, forming a somewhat stable covering for the eggs. The average number of eggs per female in this study

TABLE 3.—Number of eggs found in ovaries of *Schistocerca obscura* females collected from the field.

Date of Collection	Number of Eggs
Sept. 30	110
Aug. 20	120
Aug. 20	116
Aug. 28	87
Oct. 16	167
July 26	118
Aug. 8	70
July 28	109
July 28	114
Aug. 21	116
Aug. 21	119
Oct. 16	101
July 25	93
Average number of eggs	108.4

was found to be 75.4 for the first pod, 42 for the second and 31 for the third pod. These averages are based on 35, 10 and 4 records respectively. In a few cases a fourth egg pod was deposited but the number of eggs in these was not determined.

At various times, females collected from the field were dissected to determine the number of mature eggs in the ovaries. Over this period, extending from July 25 until October 16, 1938, 13 females were examined. It is not known whether these females had previously oviposited or not, but it may be assumed in some cases they had in view of the late dates on which they were taken. Table 3 gives the results of this study.

The pre-oviposition period, or the period from the last molt until the time of oviposition, has been determined in this work to be 44.1 days. This average was taken from ovipositions of 12 females reared in the greenhouse. The average approximates that given by Ballard (1932) for the solitary phase of the desert locust in Egypt. The interoviposition periods between the first and second egg pods ranged from 5 to 11 days with an average of 8 days for 4 records. For the second and third egg pods this period was 9 and 21 days for two females.

Hatching: The eggs of this species are laid in late summer and fall and hatch the following spring. With some species of insects, overwintering at low temperatures seems to be a necessary factor in development. In the case of *Schistocerca obscura* there is no evidence to prove that this is so. Rather, there is much to indicate that the development of the embryo may be continuous if a sufficiently high temperature is maintained. Egg pods deposited in September were broken in halves and stored at both room and outside soil

TABLE 4.—Incubation Period of *Schistocerca obscura* from Eggs Stored at Room Temperature. Stillwater, Oklahoma, 1938—1939.

Cage No.	Pod Number	Date of Oviposition	Date of First Hatch	Minimum Incubation Period (days)
S3	First	Sept. 1, 1938	Jan. 8, 1939	98
S24	"	Sept. 5, 1938	Jan. 7, 1939	92
S2	"	Sept. 6, 1938	Jan. 11, 1939	105
S8	"	Sept. 7, 1938	Jan. 8, 1939	91
S25	"	Sept. 5, 1938	Dec. 10, 1938	64
S1	"	Sept. 1, 1938	Dec. 5, 1938	64
S15	"	Sept. 1, 1938	Dec. 15, 1938	74
S7	"	Sept. 1, 1938	No Hatch	
S6-1	"	Sept. 3, 1938	Dec. 7, 1938	63
S6-2	Second	Sept. 7, 1938	Jan. 3, 1939	88

Main Minimum Incubation Period (days) 83.1

temperatures. The eggs stored at room temperatures (Normal room temperatures maintained approximately at 68° F.) started hatching in December and continued to do so up until the last of February (Table 4). On examination, the eggs stored at outside soil temperatures showed very little development April 6, 1939. These eggs, however, started hatching in May and the last pod hatched early in June (Table 5). It is interesting to note that there was much difference in the total percentage of eggs hatched, between the eggs in the two localities (Table 6 and 7).

In order that the hatching process might be easily observed, a number of eggs were placed in moist sand in a tin container and allowed to stand in the sunlight until activity was seen to have begun. Time records were kept in a few cases but it soon became evident that the environment of the egg influenced the duration of the hatching period. In general, those individuals hatching after 4 o'clock in the afternoon remained in the intermediate stage until around 8 o'clock the next morning. Also removing the tin containers from direct sunlight to shade in mid-day was sufficient to decrease the activity considerably.

The average hatching time was 16 minutes, as observed from the cages in mid-day. For these same individuals the average length of the intermediate stage was 5 minutes. This stage is considered as being from the time the young are freed from the egg until the intermediate skin is shed.

To free itself from the egg, the embryo makes use of the pulsatile organ (cervicle ampula) which is plainly evident at this time, being located just back of the head. By alternate contraction and expansion of this organ the shell is

TABLE 5.—Incubation Period for Eggs of *Schistocerca obscura* at Soil Temperature. Stillwater, Oklahoma, 1938—39.

Cage No.	Pod Number	Date of Oviposition	Date of First Hatch	Minimum Incubation Period (days)
S3	First	Sept. 1, 1938	May 30	271
S24	"	Sept. 5, 1938	May 31	267
S2	"	Sept. 6, 1938	May 25	260
S25	"	Sept. 5, 1938	May 25	261
S10	"	Sept. 7, 1938	May 30	264
S1	"	Sept. 1, 1938	May 4	245
S15	"	Sept. 1, 1938	May 3	244
S6-2	Second	Sept. 7, 1938	June 2	274
S7	First	Sept. 1, 1938	May 27	268
S6-1	"	Sept. 3, 1938	May 21	259

Mean Minimum Incubation Period (days) 261.3

burst and the nymph makes its way from the egg. According to Uvarov (1928) the movement to the surface of the ground is accomplished in much the same way. The movement of the cervicle ampula forces the soil particles to one side; and, on contraction, the young grasshopper moves upward through the space left by the displaced soil particles.

Uvarov (1928) states that light is a necessary factor in the intermediate

TABLE 6.—Average hatch for *Schistocerca obscura* Eggs Stored at Room Temperatures. Stillwater, Oklahoma, 1938—39.

No. Cage	of Eggs Number	Number of Hatched 5ggs	Percent of Eggs Hatched
S3	25	3	12.00
S24	17	3	17.64
S2	18	4	22.22
S8	22	2	9.09
S25	21	4	19.04
S10	29	3	10.34
S1	14	1	7.10
S15	31	1	3.20
S6-1	23	2	8.69
S7	21	1	4.76
S6-2	22	1	4.54
Average			10.87

TABLE 7.—Average Hatch for *Schistocerca obscura* Eggs Stored at Soil Temperatures. Stillwater, Oklahoma, 1938—39.

Cage No.	Number of Eggs	Number of Hatched 5ggs	Percent of Eggs Hatched
S3	15	6	40
S24	45	6	11.11
S2-1	52	10	19.23
S25	137	44	32.11
S10	28	22	78.57
S6-2	54	41	75.92
S7	45	38	84.44
S6-1	129	76	58.91
Average			50.30

molt and that the young grasshoppers will not hatch, move to the surface of the ground, or molt in the absence of light. With this species it was found that the young would hatch, move to the surface, and complete the intermediate stage in the absence of light. In some cases considerable development toward the second instar was accomplished before death occurred. In this experiment, the eggs at the time of oviposition were confined in tin boxes with tight fitting lids. The boxes were not opened until the insects had reached the various stages of development as stated above. Twenty-four young were hatched in this manner, of which 22 completed the intermediate molt.

Rate of Development: *Schistocerca obscura* developed fastest at the highest temperature maintained during this study, namely 89.8° F. (Table 8). At this mean temperature it completed its development, on an average, in 46.1 days. At the slightly lower mean temperature of 85° F. development was completed, on an average, in 51.2 days; and it is interesting to note that development of the insects reared at outside conditions was completed in approximately the same time. No nymphs were reared to maturity at the lower temperatures maintained because the experiment was terminated before these records could be obtained. However, development was retarded in the earlier instars at these temperatures. As expected, there was considerable range in the duration of the development at the different temperatures.

TABLE 8.—Number of Days Development of *S. obscura* Nymphs at Different Temperatures. Stillwater, Oklahoma, 1938

Instar	Mean Temperature During Period of Development OF.						Outside Check
85.0	75.8	70		85.9			
1	7.4	7.5		10.2	11.1	8.6	
		10*	17	4	23		57
2	5.2	6.0		8.2	10.2	7.0	
		10	17	4	15		48
3	11.2	13.4		.....	14.1	10.1	
		8	7		17		45
4	11.9	12.7		.....	17.7	13.1	
		5	4		9		47
5	10.4	11.6		.....	.....	12.7	
		4	4				40
Total	46.1	51.2		.....	.....	51.5	

*Lower right-hand corner represents number of records.

REACTION OF NYMPHS OF *SCHISTOCERCA OBSCURA* TO POPULATION DENSITIES AND CONTROLLED TEMPERATURES.

While collecting nymphs in the field it was noticed that occasionally individuals of extremely dark coloration appeared. These, on molting to the adult stage, produced the typical *Schistocerca obscura*, which could not be distinguished from those adults reared from the green nymphs. In the field no gradations were noticed by which the dark colored forms could be connected with the typical green forms.

In rearing the typical green specimens it was noticed that those individuals reared in the greenhouse gradually developed a darker coloration in pattern. However, they never reached such an extreme of coloration as the few collected from the field. A complete gradation from the extreme dark phase to the typical solid green phase was never found in the work of 1938. As mentioned before, the green nymphs showed considerable variation from each other but the dark purplish phase seemed constant.

Since the greenhouse temperatures were below those recorded for the outside, the tendency of the nymphs to change colors suggested that temperature was one of the influencing factors. It also seemed possible that the apparently two different types might be regarded as the results of two different genetic strains. It was decided, therefore to rear nymphs at different temperatures the following summer to see if an explanation was available as to the relationship of the nymphal variation.

Method of Experimentation: The temperature experiments with *Schistocerca obscura* were carried out with the aid of specially constructed temperature cabinets, equipped with thermostatic controls. Constant temperatures ranging from 89.9 to 70 degrees F. were maintained throughout the course of the experiment. The four temperatures maintained during the first part of the experiment were 89.9, 85-70, and 70 degrees F. Later the cages with fluctuating temperatures (85-70 F.) were discontinued. Check experiments were carried on at outside conditions. All dates of moulting and development of the nymphs were recorded. Coloration was checked at one day after moulting in each case in order that equal evaluation might be given to each individual. The food consisted of elm leaves, which were supplied each morning. The rearing cages were made of circular wire gauze placed over flower pots, and all checks on coloration and measurements were taken under a microscope at 23 magnifications.

Color Development: In Table (9) is shown the principal color development of nymphs of *Schistocerca obscura* reared at different temperatures and population densities. Only the characteristic colors or general color patterns are included; to do otherwise would go beyond the bounds of tabulation. This table therefore shows the principal differences as they occurred. The variations and intensities developed here in *Schistocerca obscura* are as extreme as those described by other workers for species known to exhibit the migratory phase. With the adults, however, this work terminated before indicative

TABLE 9.—Comparison of Color Development in *S. obscura* Nymphs Reared at Different Temperatures and Population Intensities.

Temperatures (° F.).	Population Condition	GENERAL COLORATION				
		1st Stage Nymphs	2nd Stage Nymphs	3rd Stage Nymphs	4th Stage Nymphs	5th Stage Nymphs
70°	Crowded 2	Deep green	Deep green black speckling *11	Black 12	Black-yellowish-black spotted 10	Black-reddish brown 8
	Isolated 1	Deep green	Deep green *5	Deep green 3	Deep green black spotted 10	Deep green heavy black spotted 12
	Crowded	Deep green	Green 16	Green with black speckling 11	Green with black speckling 10	Brown-pinkish brown 10
85°	Isolated	Deep green	Light green 8	Light green 2	Whitish to light green 4	Whitish green 4
	Crowded	Deep green	Light green 12	Light green black speckling 14	Olive green black speckling 8	Light tan 8
	Isolated	Deep green	Very light green 8	Very pale light green 3	Very pale light green 3	Very pale bluish green to dirty white 4
89.9°	Crowded	Deep green	Deep green black speckling 10	Black 50	Black with yellow blotches 10	Black-reddish brown 10
	Isolated	Deep green	Deep green 7	Deep green black specks 2	Deep green black speckling 2	Deep green heavy black spotted 2
	Outside					

* Number of specimens examined; This number represents average of lot reared at each particular condition: 1 Isolated—one specimen per cage; 2 Crowded—10-40 individuals per cage; 3 Typical green 1st stage nymphs.

data could be obtained, and whether they would show migratory phase characteristics is not known.

That temperature had some effect on the intensity of coloration of *Schistocerca obscura* nymphs is seen by comparing the cases described in Table 9, where all the nymphs reared under the same population conditions but under different temperatures, vary in their coloration. All of the crowded nymphs show a darker coloration than the isolated nymphs but within themselves this group exhibits a gradation from lighter to darker coloration as the corresponding temperatures run from high to low.

With this species, however, the most important factor contributing toward a darker pigmentation seems to be population density. Crowded nymphs show far greater development of dark color than the isolated nymphs reared at the same temperature. A crowded condition seems to exist when more than two nymphs are reared together in a cylindrical cage 8 inches in length by 3½ inches in diameter. In some cages as many as 40 nymphs were so reared. These showed an extreme development of black color.

Movement could be observed at all times in the cages containing the crowded nymphs. As the number of nymphs was increased per cage the movement became more noticeable. That movement is a contributing factor in color arrangement has been shown by Husain (1936). This writer found that nymphs could be kept moving by arrangement of a special revolving tube. The nymphs so reared developed black coloration regardless of the temperature and population conditions.

SUMMARY

In the region of Stillwater, Oklahoma, cotton, elm, green mature corn, leaves, persimmon and young wheat are preferred foods for the *Schistocerca obscura*.

The pre-copulation period of the female was found to be 18 days. The pre-oviposition period after copulation was 44.1 days. The inter-oviposition period between the first and second egg pods was found to average 8 days and between the second and third pods it ranged from 9 to 21 days. The average number of eggs per pod was found to be 75.4 for the first pod, 42 for the second and 31 for the third.

The incubation period averaged 261.3 days for eggs stored at outside temperatures and 83.1 days for eggs stored at room temperatures of approximately 68°F. The average hatch for the eggs stored at the two conditions was found to be 10.87 percent for those eggs stored at room temperature and 59.30 percent for those stored at outside temperatures.

Total duration of the nymphal period at outside temperatures was found to be 51.5 days as compared with 46.1 days for those reared at 89.9°F., and 51.2 days for those reared at 85°F. Nymphs reared at the lower temperature of 70°F. did not complete the fifth nymphal period before termination of the work but development of the earlier stages at lower temperatures indicated that much more time would be required at these temperatures.

Temperature and population density, especially the latter, were found to affect color development to a marked degree; lower temperatures and crowding producing the darker forms.

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SOME NEW SPECIES OF CUERNA (Homoptera-Cicadellidae)

P. W. OMAN, United States National Museum
and
R. H. BEAMER, University of Kansas

In order that some of the specific names may be available in disease transmission studies, the following descriptions are published in advance of a revision of the genus. A key to the species and illustrations will be published later.

Cuerna occidentalis, n. sp.

Resembles *C. limbata* (Say) but is bronze in color instead of black, with veins often light. Length 6-8 mm.

Structure: Distance between eyes is to median length of crown as 4.5 is to 3.5. In dorsal view front margins of head almost straight, slightly less than a right angle, apex sharp for this genus.

Color: Head, pronotum and scutellum black with rather fine light markings. Light arcs of front usually covering outer third of anterior half of crown, leaving a dark wedge-shaped area between them. Elytra bronze in color, quite rugulose, veins light or dark, apical cells whitish subhyaline.

Genitalia: Aedeagus with two pairs of basal processes. In caudal view inner pair about half as long as outer, widest at base, gently curved in to almost touch just before middle, then curved out to end about even with small blunt teeth on aedeagal shaft; outer pair widest at base, arising dorsad of base of inner pair, diverging at about a right angle an basal two thirds, then curving parallel with aedeagal shaft, tapered on outer third, curving caudad to end in sharp points slightly beyond apex of aedeagal shaft. In lateral view inner processes widest on basal third, straight, paralleling aedeagal shaft, gradually tapered on outer two thirds to short points; outer processes slightly wider than inner, about parallel-sided on

basal two thirds, sides sharply converging and often curving slightly caudad on outer third to end just beyond tip of aedeagal shaft.

Holotype male, allotype female and 7 female paratypes, Mint Canyon, Calif., July 6, 1933, J. D. Beamer. Other paratypes: 9 males and 16 females, Alpine, Calif., July 9, 1929, R. H. Beamer; 7 males and 8 females, San Jacinto Mts., Calif., July 21, 1929, R. H. Beamer; 5 males and 4 females, same data, July 31, 1936; 12 males and 10 females, San Diego, Calif., July 4, 1929, L. D. Anderson; 3 males and 3 females, same data, R. H. Beamer; 4 males and 4 females, Santa Maria, Calif., July 19, 1932, R. H. Beamer; 2 males and 2 females, Beaumont, Calif., July 26, 1933, R. H. Beamer; 5 males and 1 female, Laguna Mts., Calif., July 6, 1929, R. H. Beamer; 1 male and 2 females, Laguna Beach, Calif., July 25, 1933, R. H. Beamer; 10 males and 14 females, Anza, Calif., July 29, 1938, R. I. Sailer; 5 males, same data, R. H. Beamer; 2 males and 2 females, Atascadero, Calif., July 19, 1933, R. H. Beamer; 3 females, Redlands, Calif., Aug. 8, 1940, Christenson; 1 male and 2 females, Cala. 2353, C. F. Baker; 1 female, Los Angeles Co., Calif., Coquillett; 1 male, Glenville, Calif., Aug. 30, 1918, A. Wetmore.

Types and paratypes in the Snow Entomological Collections; paratypes in the United States National Museum.

***Cuerna obtusa* n. sp.**

Resembling *C. lateralis* Fabr. but distinctly smaller, crown without a yellow marginal line between eyes; angle of front margin of head usually greater than a right angle and outer processes of aedeagus in lateral view extending about half their length caudad to shaft of aedeagus. Length 6.5 to 7.5 mm.

Structure: Distance between eyes is to median length of crown as 5 is to 3. Front margin of head usually obtuse, broadly rounded.

Color: Head, pronotum and scutellum black with ivory to yellow spots, front margin of crown without yellow stripe connecting eyes. Elytra with costal area red, tips of elytra including apices of anteapicals usually evenly subhyaline, remainder lighter red with dark longitudinal stripes in the cells.

Genitalia: Aedeagus with two pairs of processes. In caudal view inner pair heavy, reaching at least a fifth their length beyond tip of aedeagal shaft; outer processes more slender, curving caudad on outer third; aedeagal shaft with swelling on outer third about as wide as tip with two pairs of stubby teeth on outer margin. Aedeagus in lateral view with inner processes sharp, broadest near outer third and extending beyond shaft; outer processes as wide as inner, rather evenly curved caudad from base to tip, widest about middle, extending almost half their length caudad of shaft.

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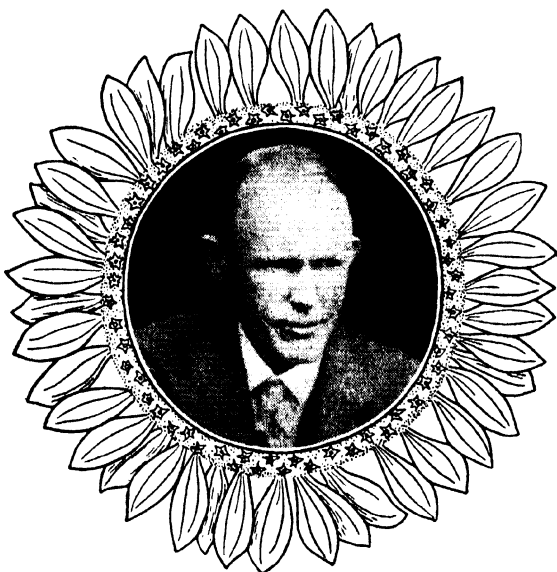
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SOME NEW SPECIES OF CUERNA (Homoptera-Cicadellidae)

P. W. OMAN, United States National Museum
and

R. H. BEAMER, University of Kansas

Continued from July Number

Holotype male, allotype female, 9 male and 8 female paratypes, Flagstaff, Ariz., July 7, 1936. Other paratypes: 3 males and 3 females, Grand Junction, Colo., Aug. 15, 1936; 1 female, Coconino Co. Ariz., Aug. 13, 1927; 1 male, Grand Canyon, Ariz., Aug. 11, 1927; 1 female, Red Lake, Ariz., Aug. 5, 1933. All the above taken by R. H. Beamer.

Types and paratypes in the Snow Entomological Collections and paratypes in the United States National Museum.

Cuerna yuccae, n. sp.

Resembling *C. obtusa* but lateral margins of head usually forming a right angle or less and the costal area of elytra with dark markings. Length 7-8 mm.

Structure: Distance between eyes is to median length of crown as 4.5 is to 3.75. Apex of head rather sharp, marginal line in dorsal view but slightly curved, antennal hood prominent.

Color: Head, pronotum and scutellum black with yellow spots and dashes, variable in number; crown without a yellow marginal line between eyes. Elytra vary from pink to gray with black, in more or less irregular patches in the cells, except in the apicals and sometimes even in these. This includes dark patches in the costal area which, with the usual gray appearance, distinguishes this species from most others.

Genitalia: Aedeagus with two pairs of processes. In caudal view inner pair narrower near base than on outer third, often crossing each other near base, narrower in widest place than outer pair and about as long as aedeagal shaft; outer pair widest beyond middle, curved in and caudally near outer third; aedeagal shaft widened near outer third with a pair of stout, heavy teeth. Aedeagus in lateral view with inner pair of processes widest on outer half, about as long as shaft; outer pair of processes sharply bent caudad near middle, widest on basal half, narrowed near middle and widened again near base of outer half.

Holotype male, allotype female, 16 male and 12 female paratypes, Palm-dale, Calif., July 6, 1933, R. H. Beamer. Other paratypes: 7 males and 7 females, Mojave, Calif., July 7, 1933 R. H. Beamer; 11 males and 7 females, Yucca Grove, Calif., Aug. 7, 1936 R. H. Beamer; 1 male and 7 females, same

data, D. R. Lindsay; 5 males and 3 females, same data, M. B. Jackson; 10 males and 5 females, Cajon Pass, Calif., Aug. 6, 1936, D. R. Lindsay; 2 males and 2 females, same data, R. H. Beamer; 2 males and 2 females, same data, M. B. Jackson; 4 males and 2 females, Mojave, Calif., June 6, 1935, P. W. Oman; 12 males and 8 females, north of Palmdale, Calif., June 8, 1935, P. W. Oman.

This leafhopper was taken from species of yucca, especially the Joshua Tree. Other specimens were examined from California, Utah and Arizona which were not made paratypes. Those from Arizona were distinctly more reddish but the genitalia, as well as other external characters, agreed.

Types and paratypes in the Snow Entomological Collections and paratypes in the United States National Museum.

***Cuerna balli*, n. sp.**

Resembling *C. yuccae* but smaller, elytra with much less black in cells and a broad yellow stripe on margin of head from eye to eye. Length male 6.5 mm.; female 7.5 mm.

Structure: Distance between the eyes is to the median length of crown as 4 is to 3. Crown broadly rounded but sides slightly less than a right angle.

Color: Head, pronotum and scutellum black, fairly well covered with large yellow spots. Crown with rather broad, definite marginal stripe from eye to eye. Longitudinal yellow marks on scutellum heavy. Elytra red to pink, slightly lighter toward dorsum, veins black, black marking in cells almost wanting; apices of anteapicals and apical cells subhyaline.

Genitalia: Aedeagus with two pairs of processes. In caudal view inner pair of processes almost touching and quite slender near base, enlarged to twice that width on outer third, extending slightly beyond shaft; outer pair of processes about twice as broad at base as inner pair, slightly wider near middle and curving caudad and ventrad back even with its base; aedeagal shaft enlarged on outer third with a sharp tooth either side. Aedeagus in lateral view with inner pair of processes narrowest just beyond base, broadened, spear-shaped at apex to end slightly beyond apex of shaft; outer pair thickest beyond base, curving sharply caudally near basal third and ventrally at outer third to end almost even with its base.

Holotype male, allotype female, 2 male and 4 female paratypes, Baboquivari Mts., Ariz., Nov. 10, 1937, P. W. Oman.

Types and paratypes in the United States National Museum. One pair of paratypes in the Snow Entomological Collections.

***Cuerna obesa* n. sp.**

Resembling *C. lateralis* in general shape but much shorter in comparison to width and with very little dark in cells of elytra. Length male 5.5 mm.; female 7 mm.

Structure: Distance between eyes is to the median length of crown as 4.75 is to 2.75. In dorsal view head slightly greater than a right angle,

broadly rounded at apex. Body short and wide, distinctly wider through elytra than eyes.

Color: Head, pronotum and scutellum black with large yellow spots and blotches, crown with definite marginal yellow band from eye to eye; elytra with costal area red, remainder somewhat lighter, only faint outlines of black stripes in cells, usually a broad, light border to mesal margin, veins black; apical cells and apices of anteapicals whitish semihyaline.

Genitalia: Aedeagus with two pairs of processes. In caudal view inner pair wider than outer, arising close together at base, gradually widening to middle, then narrowing and converging to cross each other, ending short of apex of aedeagal shaft; outer pair widely diverging at base with sides parallel to middle, then converging and curving in to end near shaft about one fourth distance from apex; aedeagal shaft without a swelling on outer third. Aedeagus in lateral view with inner pair of processes wider and sword-shaped; outer pair narrower, curving in and caudad.

Holotype male, allotype female and 11 male and 18 female paratypes, Silver City, New Mexico, July 22-23, 1936, R. H. Beamer. Other paratypes: 7 males and 8 females, same data, D. R. Lindsay; 12 males and 6 females, Mescalero, New Mexico, July 15, 1936, R. H. Beamer; 2 males and 1 female, Potter Co., Tex., July 7, 1927, R. H. Beamer; 3 males and 3 females, Marfa, Tex., June 6, 1908, Mitchell and Cushman.

Types and paratypes in the Snow Entomological Collections and paratypes in the United States National Museum.

***Cuerna alta*, n. sp.**

Resembling *C. obesa* but much longer in proportion to its width, margin of crown usually without a light line from eye to eye and inner processes of aedeagus longer than outer. Length 8-8.75 mm.

Structure: Distance between eyes is to the median length of crown as 5.75 is to 3.25. Lateral margins of head in dorsal view distinctly more than a right angle with apex broadly rounded.

Color: Head, pronotum and scutellum black with ivory and yellow spots, margin of crown usually without even a semblance of a band. Elytra with costal area red, apical cells and apices of anteapicals fumose and subhyaline, remainder lighter red or pink with quite broad longitudinal black stripes in cells, veins black.

Genitalia: Aedeagus with two pairs of processes. In caudal view inner processes appear short because one is looking almost at the point; outer pair leaving base at about a right angle with each other, then curving farther away and back again to end about even with aedeagal shaft; aedeagal shaft with a swelling near outer third with a serrated apical margin. In lateral view inner pair of processes definitely larger than outer, narrowed between base and middle, extending caudo-dorsad; outer pair of processes widest at base and near middle, curved slightly cephalad for about half its length, then caudad to end in a slender point near apex of aedeagal shaft.

Holotype male, allotype female and 6 male paratypes, Cloudcroft, New Mexico, July 27, 1940, R. H. Beamer.

Types and paratypes in the Snow Entomological Collections and paratypes in the United States National Museum.

***Cuerna alpina*, n. sp.**

Resembling *C. yuccae* but crown with a yellow marginal line between eyes and without dark markings in red costal area. Length 5.5 to 8 mm.

Structure: Distance between eyes is to median length of crown as 4.75 is to 3. Sides of head in dorsal view a right angle or slightly less, apex broadly rounded.

Color: Head, pronotum and scutellum black, more or less covered with yellow spots; elytra with costal area pink with remainder usually lighter; veins black; apical cells and apices of anteapicals whitish semihyaline, others pink to white, usually with more or less definite black stripes.

Genitalia: Aedeagus with two pairs of processes. In caudal view inner pair narrow, extending parallel to each other to end before apex of aedeagal shaft; outer pair diverge from each other at about a right angle at their base, slightly widest near middle and curve in on outer half to end near tip of aedeagal shaft; aedeagal shaft with slight enlargement on outer third with pair of teeth on anterior margin. Aedeagus in lateral view with inner pair of processes slender, widest at base, curved slightly caudad near base, then more or less parallel to aedeagal shaft, ending short of its apex; outer processes widest at base, curve slightly cephalad for half their length, then caudad and in to end near aedeagal shaft.

Holotype male, allotype female, 2 male and 2 female paratypes, Reed Point, Montana, July 11, 1934, David E. Fox. Other paratypes: 2 males and 1 female, Leadville, N. F., Sept. 1, 1914, 25 m. from Buena Vista, Colo., A. K. Fisher; 8 males and 2 females Peyton, Colo., Aug. 19, 1936, R. H. Beamer; 2 males and 1 female, Monument, Colo., Aug. 19, 1936, J. D. Beamer; 1 male and 1 female, Garden of the Gods, Colo., Aug. 19, 1936, D. R. Lindsay; 1 male, same data, M. B. Jackson; 11 males and 10 females, Portales, N. M., July 9, 1933; 1 male and 2 females, Smith Co., Kan., July 9, 1925, H. G. Grady.

Types and paratypes in the United States National Museum, paratypes in the Snow Entomological Collections.

***Cuerna gladiola*, n. sp.**

Resembles *C. occidentalis* but crown with a marginal light line between eyes and cells of elytra have black longitudinal stripes. Length 7.5 mm.

Structure: Distance between eyes is to median length of crown as 5.5 is to 3.5. Anterior margins of head in dorsal view about a right angle, apex of crown rather sharp. Elytra quite rugulose.

Color: Head, pronotum and scutellum black with rather fine light spots. Elytra reddish pink, veins black, costal area pink, unmarked, apical cells and apices of anteapicals hyaline, others pink with crenulated black marks.

Genitalia: Aedeagus with two pairs of processes and a pair of prominent

sharp teeth at dorsal margin of median swelling of aedeagal shaft. In caudal view inner pair of processes arising near each other on ventral side, widest at base, diverging to end over outer pair near their middle, evenly curved from base to tip; outer processes widest at base, diverging at less than a right angle for about two thirds their length where they begin to narrow and turn in slightly to end beyond apex of aedeagal shaft. Aedeagus in lateral view with inner pair of processes narrowed from base to tip, extending caudad at about a 30° angle; outer pair broad on basal two thirds, then narrowed to end in sharp point beyond tip of aedeagal shaft.

Holotype male, allotype female, 14 male and 18 female paratypes, Lakeview, Ore., Nov. 28, 1939, V. Johnson.

Types and paratypes in the United States National Museum; paratypes in the Snow Entomological Collections.

***Cuerna arida*, n. sp.**

Resembles *C. gladiola* but is distinctly more slender in comparison to width and the black in cells of elytra more definitely in bands. Length male 7.5 mm.; female 8.5 mm.

Structure: Distance between eyes is to median length of crown as 4.75 is to 3.25. Front margins of head in dorsal view less than a right angle, rather straight, with apex broadly rounded. The body of the male is so narrow compared to its length that it seems to be much wider through the eyes than at any other place.

Color: Head, pronotum and scutellum black, finely set with quite small white and yellow marks. Margin of crown with definite yellow line from eye to eye. Elytra reddish throughout, costal area usually darker; veins black; apical cells and apices of anteapicals more or less hyaline, others pink with fairly definite longitudinal dark stripes.

Genitalia: Aedeagus with two pairs of basal processes and a pair of prominent sharp teeth on anterior margin of median aedeagal swelling. In caudal view inner pair of processes arising widely separated on ventral margin, widest at base, diverging at a right angle, slightly sinuate, projecting laterad of outer processes and about half their length; outer processes about twice as wide and as long as inner, diverging and with sides almost parallel on slightly more than basal half, beyond narrowing and converging to end well beyond apex of aedeagal shaft. Aedeagus in lateral view with inner processes extending caudad and dorsad for two thirds its length, then bending dorsad; outer processes widest at base, extending dorsad, narrowed on outer half to end well beyond apex of aedeagal shaft.

Holotype male, allotype female, 7 male and 6 female paratypes, Chiricahua Mts., Ariz., June, 1933, P. W. Oman; 1 female, Santa Rita Mts., Ariz., June 16, 1933, P. W. Oman; 1 male and 2 females, Altar Valley, Ariz., Oct. 17, 1937, P. W. Oman; 3 males and 2 females, Baboquivari Mts., Ariz., Oct. 16, 1937, P. W. Oman; 16 males and 13 females, Chiricahua Mts., Ariz., June

. 9, 1933, R. H. Beamer; 1 male and 4 females, Santa Rita Mts., Ariz., June 12, 1933, R. H. Beamer; 1 male, same place, July 19, 1938, R. I. Sailer; 5 males and 5 females same place, April 26, 1937, W. Benedict; 1 male and 2 females, Huachuca Mts., Ariz., Aug. 1, 1927, L. D. Anderson.

Types and paratypes in the United States National Museum; paratypes in the Snow Entomological Collections.

***Cuerna mexicana*, n. sp.**

Resembles *C. arida* but larger, with a body as wide as head and eyes, and aedeagus in caudal view with inner processes not extending outside of outer processes and in lateral view inner processes extended caudally, not bent dorsally at tip. Length male 8 mm.; female 9.5 mm.

Structure: Distance between eyes is to the median length of crown as 6 is to 4. Lateral margins of head in dorsal view forming about a right angle, apex evenly rounded. Body at middle as wide as head including eyes.

Color: Head, pronotum and scutellum black, rather evenly covered with fairly large round and elongate yellow spots. Margin of crown with narrow yellow line from eye to eye, occasionally broken into spots. Elytra pink; veins black; dark stripes in all cells including costal area, except apicals and apices of anteapicals which are semihyaline.

Genitalia: Aedeagus with two pairs of processes and distinct swollen area near outer third of shaft, with pair of sharp teeth on anterior margin of this area. In caudal view inner pair of processes small, arising ventrally, separated basally by about basal width, abruptly diverging near base to end over outer pair near their middle; outer pair diverging at base at slightly less than a right angle, sides parallel on basal two thirds, outer third sharp and slightly curved in to end slightly beyond aedeagal shaft; in lateral view inner processes widest at base, gradually narrowed to sharp apices, extending parallel with aedeagal shaft with slight undulations.

Holotype male, allotype female, paratype male, Mexico; paratype female, Guatem., P. R. Uhler.

Types and paratypes in the United States National Museum.

***Cuerna alba* n. sp.**

Resembling *C. arida* but head, pronotum and scutellum definitely light colored to unaided eye and cells of elytra with very few if any dark longitudinal black stripes. Length male 6.5 mm.; female 8 mm.

Structure: Distance from eye to eye is to median length of crown as 4 is to 3. Lateral margins of head in dorsal view less than a right angle, apex round but fairly sharp for that genus.

Color: Head, pronotum and scutellum black, thickly covered with white and yellow, mostly connected blotches or lines. Margin between crown and front with fairly broad light band. Elytra with apices of anteapicals and apical cells whitish subhyaline, costal area and remainder of cells slightly lighter with scarcely any black in the cells; veins black.

Genitalia: Aedeagus with two pairs of basal processes and a swelling near outer third of shaft, the anterior margin of which is a serrated shoulder. In caudal view inner processes arise on ventral side more than the basal width of one from the other, widest at base, diverging at about a right angle, almost straight, half as long as inner processes and ending just outside of middle processes; outer processes diverging at slightly less than a right angle, sides almost parallel on basal two thirds, outer third curving in to parallel shaft and end in sharp points just beyond tip of aedeagal shaft. In lateral view inner processes about half as long as outer, widest at bases, narrowed from base to apices, curved caudad on basal half, then dorsad; outer processes broad and parallel-margined on basal two thirds, narrowed on outer third, paralleling aedeagal shaft to end slightly beyond its tip.

Holotype male, allotype female, 1 male and 5 female paratypes, White Sands, N.M., June 30, 1932, R. H. Beamer. Other paratypes; 6 males and 6 females, same place and collector, July 14, 1936; 5 females, same place and collector, July 27, 1940; 1 female, same place and date, D. E. Hardy:

Types and paratypes in the Snow Entomological Collections; paratypes in the United States National Museum.

***Cuerna curvata*, n sp.**

Resembling *C. arida* but with much more yellow on head and pronotum, without a definite yellow marginal border to crown, elytra pink with black puncts and mostly yellow veins. Length male 6.5 mm.; female 8 mm.

Structure: Distance between eyes is to median length of crown as 4.5 is to 3. Head in dorsal view with lateral margins forming slightly less than a right angle, apex broadly rounded.

Color: Head and pronotum more yellow than black, color markings connected mostly not in the form of spots. Elytra pink, veins usually light, apical and apices of anteapical cells hyaline with black veins, other cells sparsely and minutely punctate with black; claval suture dark.

Genitalia: Aedeagus with two pairs of processes. In caudal view aedeagal shaft with very little swelling near middle; inner pair of processes small, not half as wide or long as outer pair, widest at base, gradually curved outward holding about the same width to end just outside outer processes near their middle; outer processes broad, sides almost parallel on basal two thirds, then narrowing and curving in and cephalad to end short of aedeagal shaft. In lateral view inner processes at base about half as wide as outer, tapered to apex and turned out; outer pair very wide on basal four fifths, on outer fifth rapidly narrowed, turned in and cephalad.

Holotype male, allotype female, 19 male and 19 female paratypes, Lone Pine, Calif., July 28, 1940, R. H. Beamer.

Types and paratypes in the Snow Entomological Collections; paratypes in the United States National Museum.

Cuerna dixiana, n. sp.

Resembling *C. curvata* but head, pronotum and scutellum almost yellow, elytra with very few dark punctures, inner processes of aedeagus in caudal view bent sharply laterad near base and outer processes but slightly curved at apices. Length 6.5 mm.

Structure: Distance between eyes is to the median length of crown as 4.5 is to 2.5. Lateral margins of head considerably more than a right angle, apex broadly rounded.

Color: Head, pronotum and scutellum almost yellow, flecked with very fine black dots and lines, black, somewhat coarser on scutellum; elytra red; veins light except dark apicals, a very few fine dark punctures near middle, apices of anteapicals and apical cells semihyaline.

Genitalia: Aedeagus with two pairs of processes. In caudal view shaft with round swelling near outer third with a pair of sharp teeth on anterior margin; inner pair of processes about half as wide and half as long as outer pair, bent almost directly out near base, ending in stubby points just beyond outer processes; outer processes broadest at base, sides almost parallel on basal two thirds, bent almost at right angles to end just beyond apex of aedeagal shaft. In lateral view inner pair of processes extend cephalad half their length, then almost dorsad, scarcely half as wide or as long as outer pair; outer pair widest at base, almost parallel-sided on basal two thirds, then curved and narrowed to end near apex of aedeagal shaft.

Holotype male, allotype female, St. George, Utah, Sept. 20, 1936, E. W. Davis; 1 male paratype, Baker, Nev., Sept. 14, 1939; T. O. Thatcher.

Types and paratypes in the United States National Museum.

INSECTS AND OTHER ARTHROPODS COLLECTED IN PASTURE GRASSES, WASTE LANDS, AND FORAGE CROPS, MANHATTAN, KANS., 1937-1940

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Coincident with a four-year study of cutworm and armyworm (Phalaenidae) populations in pasture grasses, waste lands, and forage crops in the vicinity of Manhattan, Kans., (5) a great many other insects and other arthropods were taken under the burlap-sack traps that were used for trapping the cutworm larvae. Fourteen environments were under observation, typifying the pastures, waste lands, and forage crops of the locality. These environ-

¹ Contribution No. 532 of the Department of Entomology, Kansas Agricultural Experiment Station, Project No. 211, Bankhead-Jones.

ments, or habitats, represent the more important species of pasture grasses and forage crops in the Flint Hills area of Kansas, and are listed below:

- Little barley (*Hordeum pusillum* Nutt.), roadside
- Bluegrass (*Poa pratensis* L.), roadside
- Sweetclover (*Melilotus* sp.), test pellets
- Overgrazed pasture
- Alfalfa (*Medicago sativa* L.), old stand
- Alfalfa, new stand
- Native hay meadow, I
- Little bluestem (*Andropogon scoparius* Michx.), pasture
- Bromegrass (*Bromus inermis* Leyss.) 1937-3, oats (*Avena sativa* L.) 1939, and wheat (*Triticum aestivum* L.) 1940.
- Wild-rye (*Elymus virginicus* L.), waste land
- Dropseed (*Sporobolus heterolepis* A. Gray.) waste land
- Bromegrass, roadside
- Native hay meadow, II
- Panic grass (*Panicum virgatum* L.), waste land

Several investigators have made observations on prairie and meadow insects. Adams (1) has discussed the differences between forest and prairie insect populations. Hendrickson (3) made collections by means of a net over a four-year period in the prairie plant associations of Iowa. Whelan (6) has reported on the Coleoptera of an original prairie area near Lincoln, Neb., collecting under stones, with lights, and with an insect net. The area in which he worked was similar to the little bluestem pasture of the present study. This habitat and also barley and bromegrass pastures have been used in the study of grassland insects by Wilbur and co-workers (7, 8). Osborn (4) has discussed the ecological relationships of the meadow and pasture insects. Brandhorst (2) has reported on the insects associated with pasture forbs and weedy plants in western Kansas, some of which were found in the habitats included in the present study.

In this study habitats were chosen in which the grasses were growing in as nearly pure stands as could be found under natural conditions, or in which an unusual condition obtained such as the overgrazed pasture. Great differences in the insect and other arthropod fauna of the various habitats were noted, and the results are presented as a contribution to the ecological relationships of the species that inhabit native grasslands and forage-crop areas.

Twenty-five traps, consisting of 4 thicknesses of burlap 1 foot square, pegged down with nails, were placed in each of the 14 habitats. As only species having the habit of hiding under objects during the day would be likely to be found under such a trap, most of those taken were nocturnal.

At intervals of 3 to 10 days the traps were examined and the insects hiding underneath were collected. Numerous colonies of ants were noted under the sacks, but no record was made of the number. No record was made of Thy-

sanoptera and other small forms. Also, at times, some Coleoptera escaped when the sacks were lifted. Observations were begun in March or early in April of each year, and were continued through June with the exception of 1937, when observations were continued into November.

During the four-year period of observation totals of 7 orders, 41 families, and 225 species were taken under the traps, distributed as follows: Orthoptera 5 families, 9 species; Isoptera 1 species; Hemiptera 7 families, 19 species; Coleoptera 20 families, 163 species; Lepidoptera 3 families, 26 species; Diptera 1 species; and Hymenoptera 4 families, 6 species (including *Apanteles* sp. cocoon clusters). In addition, sowbugs, ticks, centipedes, and millepedes, as well as mice and snakes, were collected.

The comparative abundance of the various orders in the different habitats is shown in Table 1. Lepidoptera, composed largely of the larvae of Phalaenidae, were taken in greatest numbers, with Coleoptera next. The greatest numbers of specimens of all species were recovered from the little barley pasture. However, the various orders showed wide differences in habitat preference. For example, native hay meadow I was the source of the largest

TABLE 1.—Comparative abundance of insects taken under sack traps in pasture grasses, waste lands, and forage crops, Manhattan, Kans., 1937-1940.

Habitat	Number of Specimens							Percent of total
	Orthoptera	Isoptera ¹	Hemiptera	Coleoptera	Lepidoptera	Diptera	Hymenoptera	Totals
Little barley, pasture	39	18	7	128	977	....	70	1239
Bluegrass, roadside	78	....	12	107	787	....	55	1039
Overgrazed pasture	115	2	18	336	562	....	2	1035
Sweetclover	20	....	2	102	718	....	2	844
Native hay, meadow I	358	....	6	217	202	....	4	787
Dropseed, waste land	65	....	16	332	186	....	13	612
Brome grass-oats-wheat, pasture	56	2	116	107	189	....	86	556
Alfalfa, old stand	48	....	1	148	336	....	1	534
Little bluestem, pasture	132	2	6	178	199	....	....	517
Alfalfa, new stand	79	1	5	106	208	....	1	400
Wild rye, waste land	43	....	5	89	194	....	55	386
Native hay, meadow II	94	....	3	77	86	....	....	260
Panic grass, waste land	59	....	12	79	42	1	5	198
Brome grass, roadside	35	....	7	43	90	....	15	190
Total	1221	25	216	2049	4776	1	309	8597
Percent of total	14.2	0.3	2.5	23.8	55.6	....	3.6	....

¹ Numbers refer to colonies.

number of Orthoptera, whereas Coleoptera were taken in greatest abundance in the overgrazed pasture.

The abundance of the different forms varied greatly from year to year, as shown in Table 2.

TABLE 2.—Yearly variation in abundance of insects taken under sack traps in pasture grasses, waste lands, and forage crops, Manhattan, Kans., 1937-1940

Order	1937	1938	Number of Specimens		Total
			1939	1940	
Orthoptera	385	374	102	360	1221
Isoptera	24	1	.....	.....	25
Hemiptera	64	21	.....	131	216
Coleoptera	1171	374	67	437	2049
Lepidoptera	1505	2701	188	382	4776
Diptera	1	.....	.....	.....	1
Hymenoptera	295	14	.....	.....	309
Total	3445	3485	357	1310	8597
Percent of total	40.1	40.5	4.2	15.2	.....

The following list gives the species recovered from the traps, their period of occurrence, and the number of specimens taken in each habitat. Practically all the determinations were made by specialists in the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, although some of the more common forms were identified by the writers, and some of the collections of Coleoptera of 1937 by N. E. Good, formerly of this Bureau. Five snakes were recovered in wild rye, four of which were found between April and July and were identified as *Diadophis punctatus arnyi* (Kennicott) (Arny's ring neck), and the fifth, *Agkistrodon mokeson mokeson* (Daudin) (prairie copperhead), was found in October.

SOWBUGS

(Oniscidae), species undetermined, April-June:

Bromegrass, roadside	21
Bromegrass, pasture	3
Bluegrass	2
Little bluestem	1

MITES

Erythraeus phalangiulus Ewing,
May, little bluestem

1

CENTIPEDES

Geophilidae, *Arenophilus bipunctipes* (Wood), May,
wild rye

2

Lithobiidae:

Lithobius forficatus (L.), May,
native hay

1

Eurymerodaemus mundus

Chamb., May, native hay

3

Undertermined species, March-
November:

Alfalfa, old stand	161
Little bluestem	87
Dropseed	73
Bluegrass	45
Panic grass	44
Native hay I	44
Sweetclover	41

Wild rye	39	Orchelimum silvaticum Mc-	
Bromegrass, pasture	37	Neill, September, sweet-	
Overgrazed pasture	25	clover	1
Alfalfa, new stand	21	Gryllidae:	
Bromegrass, roadside	19	Acheta assimilis F., March-	
Little barley	15	November:	
Native hay II	8	Little bluestem	128
MILLIPEDES		Overgrazed pasture	92
Paraiulus sp., April, little blue-		Native hay II	63
stem	1	Alfalfa, new stand	60
Undertermined species, March-		Native hay I	59
November:		Panic grass	56
Alfalfa, old stand	101	Bromegrass, pasture	55
Little bluestem	64	Dropseed	54
Dropseed	17	Alfalfa, old stand	39
Wild rye	11	Little barley	37
Native hay I	7	Wild rye	27
Alfalfa, new stand	6	Bluegrass	25
Native hay II	5	Bromegrass, roadside	25
Sweetclover	5	Sweetclover	17
Bromegrass, roadside	2	Gryllacrididae:	
Overgrazed pasture	2	Udeopsylla robusta (Hald.),	
Little barley	1	March-November:	
Bromegrass, pasture	1	Alfalfa, new stand	17
ORTHOPTERA		Overgrazed pasture	14
Blattidae:		Alfalfa, old stand	8
Parcoblatta bolliana (S. and		Dropseed	5
Z.), May-June:		Sweetclover	2
Native hay I	2	Little barley	1
Native hay II	1	Panic grass	1
Parcoblatta pennsylvanica		Native hay I	1
(Deg.), July, wild rye	1	Bromegrass, roadside	1
Parcoblatta sp., March-November:		Native hay II	1
Native hay I	295	Acrididae:	
Bluegrass	53	Pardalophora sp., May:	
Native hay II	28	Little barley	1
Wild rye	14	Native hay I	1
Bromegrass, roadside	9	Native hay II	1
Overgrazed pasture	9	Melanoplus bivittatus (Say),	
Dropseed	6	September:	
Little bluestem	4	Alfalfa, new stand	1
Panic grass	2	Bromegrass, pasture	1
Tettigoniidae:		Hadrotettix trifasciatus (Say),	
Amblycorypha sp., June, wild		June, alfalfa, old stand	1
rye	1		

ISOPTERA

Termitidae:

Termite colonies, April-October:

Little barley	18
Little bluestem	2
Bromegrass, pasture	2
Overgrazed pasture	2
Alfalfa, new stand	1

HEMITERA

Cydnidae:

Galgupha ovalis Hussey, April dropseed

1

Galgupha sp., April-October:

Overgrazed pasture	7
Dropseed	5
Native hay I	5
Bluegrass	3
Little barley	1
Bromegrass, roadside	1
Sweetclover	1
Alfalfa, old stand	1

Pentatomidae:

Peribalus limbolarius Stål, March, overgrazed pasture

2

Thyanta accerra McA., March, October-November:

Overgrazed pasture	3
Bluegrass	1
Little bluestem	1
Panic grass	1

Thyanta custator (F.), April alfalfa, new stand

1

Aelia americana Dall., March, June, November:

Little barley	4
Overgrazed pasture	3
Little bluestem	2
Wild rye	2
Bluegrass	1

Coreidae:

Coriscus pilosulus (H. S.), October, native hay II

1

Lygaeidae:

Lygaeus kalmii Stål, April-May, November:

Dropseed	3
Alfalfa, new stand	2
Wild rye	1

Blissus leucopterus (Say),

March-June:	
Wheat, pasture	114
Panic grass	11
Dropseed	5
Bromegrass, roadside	5
Bluegrass	4
Little barley	2
Little bluestem	2
Native hay II	1
Overgrazed pasture	1
Sweetclover	1
Alfalfa, new stand	1

Geocoris pallens Stål, May-July:

Bromegrass, pasture	2
Overgrazed pasture	1

Myodocha serripes Oliv., April alfalfa new stand

1

Peritrechus fraternus Uhl, April, dropseed

1

Malezonotus rufipes (Stal), April, dropseed

1

Aphanus umbrosus (Dist.), May, July:

Bluegrass	1
Native hay I	1
Bromegrass, roadside	1

Emblethis vicarius Horv.,

July, overgrazed pasture

1

Reduviidae:

Melanolestes picipes (H. S.), May-June:

Bluegrass	1
Little bluestem	1

Onocephalus sp., April, May:

Bluegrass	1
Native hay II	1

Nabidae:		Calosoma calidum (F.), April,	
Pagasa sp., May, wild rye	1	sweetclover	2
Miridae:		Calosoma sp., probably calidum	
Capsus simulans (Stal), May		(F.), May-June:	
wild rye	1	Sweetclover	1
		Alfalfa, new stand	1
DIPTERA			
Empididae:		Calosoma sp. (larvae), May-	
Rhamphomyia sp. April, panic		June, dropseed	5
grass	1	Pasimachus punctulatus Hald.,	
COLEOPTERA			
Carabidae:		April-August:	
Calosoma (Callitropa) exter-		Native hay I	15
num (Say), May-June:		Overgrazed pasture	6
Sweetclover	4	Panic grass	1
Dropseed	2	Alfalfa, new stand	1
Wild rye	2	Wild rye	1
Native hay II	2	Pasimachus elongatus Lec.,	
Bromegrass, pasture	1	April-September:	
Alfalfa, new stand	1	Native hay II	39
Alfalfa, old stand	1	Little bluestem	36
Calosoma scrutator (F.),		Native hay I	31
May-June:		Alfalfa, old stand	28
Wild rye	2	Bromegrass, pasture	11
Native hay I	1	Overgrazed pasture	10
Calosoma lecontei (Csiki),		Sweetclover	10
May-July:		Little barley	9
Native hay I	4	Alfalfa, new stand	6
Sweetclover	4	Dropseed	4
Alfalfa, new stand	4	Bromegrass, roadside	2
Alfalfa, old stand	3	Pasimachus sp. (larvae),	
Dropseed	2	May-June:	
Panic grass	1	Sweetclover	3
Calosoma triste Lec.,		Bromegrass, roadside	2
June-September:		Alfalfa, old stand	1
Alfalfa, new stand	4	Scarites subterraneus F.,	
Alfalfa, old stand	1	May-June, October:	
Sweetclover	1	Alfalfa, old stand	9
Calosoma obsoletum Say,		Alfalfa, new stand	9
May-September:		Bluegrass	3
Alfalfa, new stand	7	Bromegrass, pasture	3
Bluegrass	3	Bromegrass, roadside	2
Sweetclover	2	Wild rye	2
Alfalfa, old stand	1	Dropseed	1
Native hay I	1	Native hay I	1
		Sweetclover	1

Scarites substriatus Hald.,

April-June:

Bluegrass	4
Wild rye	3
Alfalfa, new stand	3
Bromegrass, pasture	1
Native hay II	1
Sweetclover	1

Dyschirius globulosus (Say),

April, sweetclover

Dyschirius sp., April:

Dropseed	1
Alfalfa, old stand	1

Clivina bipustulata (F.),

May-June:

Wheat, pasture	1
Bromegrass, roadside	1

Aspidoglossa subangulata (Chd.),

June, alfalfa old stand

Bembidion intermedium Kby.,

April-May:

Dropseed	1
Sweetclover	1

Pterostichus (Anaferonia) substriatus Lec., June, October-

November:

Little barley	2
Overgrazed pasture	1
Native hay I	1

Pterostichus (Anaferonia) constrictus Say, May-October:

Overgrazed pasture	27
Little bluestem	5
Native hay I	5
Little barley	4
Bromegrass, pasture	4
Alfalfa, old stand	3
Native hay II	1

Pterostichus (Anaferonia)**iowanus** Csy., March, November:

Little bluestem	1
Wild rye	1

Pterostichus (Eumolops) sexualis

Csy., April-June:

Overgrazed pasture	5
Little barley	2
Bluegrass	1
Sweetclover	1
Bromegrass, pasture	1
Bromegrass, roadside	1
Native hay I	1
Alfalfa, new stand	1

Pterostichus (Eumolops) colossus

Lec., April-June:

Alfalfa, old stand	5
Bluegrass	3
Sweetclover	3
Native hay II	3
Overgrazed pasture	1

Pterostichus (Eumolops) sp.,near **colossus** Lec., May,

bluegrass

Pterostichus (Eumolops) torvus

Lec., April-October:

Alfalfa, old stand	4
Overgrazed pasture	11
Bromegrass, pasture	3
Sweetclover	2
Bromegrass, roadside	2
Alfalfa, new stand	1
Dropseed	1

Pterostichus (Evarthrus) sex-**impressus** Lec., June-August:

Bluegrass	1
Sweetclover	1
Wild rye	1
Native hay II	1

Pterostichus (Abacidus) permun-**dus** Say., June, September-October:

Wild rye	6
Bluegrass	2
Sweetclover	1

Pterostichus (Gastrosticta) putus

Csy., October, wild rye

Pterostichus (Poecilus) chalcites

Say, March-October:

Alfalfa, new stand	17
Alfalfa, old stand	4
Little barley	3
Wheat	1
Bromegrass, roadside	1

Pterostichus (Poecilus) lucublandus (Say), May, wild rye 1**Pterostichus (Omaseulus) femoralis** Kby., May-November:

Wild rye	14
Bluegrass	2

Blechrus sp., April, dropseed 1**Amara (Curtonotus) carinata** Lec.,

April-June, September:

Wild rye	4
Sweetclover	1
Little barley	1
Alfalfa, new stand	1

Amara (Curtonotus) carinata Lec., or **adstricta** Putz., May-June:

Little barley	1
Panic grass	1
Bluegrass	1
Wild rye	1

Amara (Curtonotus) sp., near **pennsylvanica** Hayw., May, overgrassed pasture 1**Amara** sp., near **confusa** Lec.? and **subpunctata** Lec.? March-

June, dropseed 7

Amara (Percosia) obesa (Say), May-September:

Dropseed	8
Sweetclover	8
Alfalfa, old stand	8
Bromegrass, pasture	2
Bluegrass	1

Amara (Celia) muscula Say, April-May:

Panic grass	21
Dropseed	4
Alfalfa, old stand	1

Amara fallax Lec., March-May, July:

Dropseed	8
Sweetclover	7
Native hay I	6
Bromegrass, roadside	2
Wild rye	2
Alfalfa, new stand	2
Native hay II	1
Bluegrass	1
Little barley	1

Amara sp., April-June, dropseed 46**Amarini**, genus unknown (larvae), April, dropseed 6**Rembus obtusus** Lec., May, dropseed 2**Calathus opaculus** Lec., June, panic grass 1**Agonum placidum** (Say), April-May:

Panic grass	1
Sweetclover	1

Agonum (Circinalia) crenistriatus Lec., May, dropseed 1**Galerita janus** F., May, September:

Dropseed	2
Native hay I	2
Native hay II	1
Alfalfa, old stand	1
Panic grass	1
Wild rye	1
Alfalfa, new stand	1

Lebia solea Hentz, May, native hay I 1**Philophuga viridicollis** (Lec.), November, alfalfa new stand 1**Cymindis pilosa** Say, June:

Overgrazed pasture	3
Native hay I	2
Little barley	2

Cymindis sp., June, native hay II 1

Colliuris pennsylvanica (L.),

April, July:

Overgrazed pasture	1
Alfalfa, old stand	1

Brachynus sp., May-June, October:

Alfalfa, old stand	5
Native hay I	4
Overgrazed pasture	2
Alfalfa, new stand	2
Wild rye	1
Native hay II	1
Bluegrass	1
Little barley	1

Chlaenius tomentosus Say, April-September:

Bromegrass, pasture	8
Panic grass	3
Overgrazed pasture	3
Native hay II	3
Little bluestem	2
Bromegrass, roadside	2
Native hay I	2
Sweetclover	1
Dropseed	1
Little barley	1

Chlaenius kuntzenzi Csiki,

May-July:

Wild rye	1
Sweetclover	1
Alfalfa, old stand	1

Chlaenius kuntzenzi Csiki or platyderus Chd., May,

panic grass

Cratacanthus dubius (Pal. de B.),

May-October:

Little barley	29
Bromegrass, pasture	12
Overgrazed pasture	11
Dropseed	4
Sweetclover	1
Alfalfa, old stand	1

Harpalus (Pharus) indianusCsiki, September-October,
dropseed**Harpalus (Megapangus) caliginosus (F.), May-October:**

Overgrazed pasture	44
Alfalfa, new stand	11
Native hay I	6
Dropseed	3
Alfalfa, old stand	2
Bromegrass, pasture	2
Native hay II	1

Harpalus (Plectralidus) erraticus

Say, November, dropseed

Harpalus vagans Lec., May-July,
wild rye**Harpalus erythropus Dej.,**

May-September:

Overgrazed pasture	7
Panic grass	4
Native hay II	1

Harpalus compar Lec., June-September, overgrazed pasture**Harpalus faunus Say, May-August:**

Bromegrass, pasture	3
Overgrazed pasture	2

Harpalus pennsylvanicus (Deg.),

May-October:

Wild rye	6
Alfalfa, old stand	4
Bluegrass	2
Alfalfa, new stand	1

Harpalus herbivagus Say, April-June, October:

Little barley	17
Alfalfa, old stand	14
Bluegrass	5
Bromegrass, pasture	4
Overgrazed pasture	3
Sweetclover	2
Dropseed	2
Panic grass	1

Harpalus fulgens Csiki, May-June:

Wild rye	5
Bluegrass	2

Harpalus sp. (<i>fallax</i> group), May:	Little bluestem	1
Wild rye	Overgrazed pasture	1
Bromegrass, roadside	Little barley	1
Selenophorus ellipticus Dej.,	Wild rye	1
April, dropseed	Alfalfa, new stand	1
Selenophorus pedicularius Dej.,	Anisodactylus (<i>Tripectrus</i>) <i>dul-</i>	
April, dropseed	<i>cicollis</i> (Laf.), April, over-	
Discoderus parallelus (Hald.),	grazed pasture	1
March-October:	Anisodactylus (<i>Anisodactylus</i>)	
Dropseed	<i>furvus</i> Lec., April, drop-	
Overgrazed pasture	seed	1
Little barley	Anisodactylus (<i>Pseudamphasia</i>)	
Discoderus sp., near <i>parallelus</i>	<i>sericeus</i> Harr., April-June,	
(Hald.), May, little blue-	dropseed	3
stem	Anisotarsus sp., May-June,	
Anisodactylus (<i>Tripectrus</i>) <i>car-</i>	August:	
<i>bonarius</i> (Say), April-June:	Panic grass	3
Alfalfa, old stand	Sweetclover	1
Dropseed	Stenocellus rupestris (Say),	
Overgrazed pasture	April-June:	
Bromegrass, pasture	Little bluestem	37
Bluegrass	Little barley	2
Little barley	Bluegrass	1
Native hay I	Stenolophus conjunctus (Say),	
Anisodactylus (<i>Tripectrus</i>) <i>rus-</i>	April-June:	
<i>ticus</i> (Say), April-October:	Dropseed	70
Overgrazed pasture	Little barley	12
Dropseed	Little bluestem	12
Little barley	Panic grass	4
Native hay I	Dropseed	4
Sweetclover	Sweetclover	2
Bromegrass, pasture	Overgrazed pasture	1
Panic grass	Agonoderus (<i>Tachistodes</i>) <i>par-</i>	
Little bluestem	<i>tarius</i> (Say), March-April,	
Bluegrass	dropseed	6
Bromegrass, roadside	Agonoderus lecontei Chd., March-	
Alfalfa, old stand	May, September:	
Wild rye	Dropseed	4
Anisodactylus (<i>Tripectrus</i>) sp.,	Bluegrass	2
near <i>rusticus</i> (Say), May:	Wild rye	1
Little barley	Agonoderus comma (F.) or	
Panic grass	<i>lecontei</i> Chd., April- May,	
Anisodactylus (<i>Tripectrus</i>) <i>pin-</i>	July, October:	
<i>guis</i> Lec., May-June:	Dropseed	34
Bluegrass		

Sweetclover	2	Panic grass	3
Alfalfa, new stand	1	Wild rye	1
Agonoderus sp., March,		Little barley	1
dropseed	5	Saprinus sp., April, dropseed	1
Silphidae:		Lampyridae:	
Necrophorus marginatus (F.),		Photinus sp., July, overgrazed	
May, overgrazed pasture	1	pasture	1
Staphylinidae:		Melyridae:	
Omalium sp., May, panic grass	1	Collops quadrimaculatus (F.),	
Lathrotaxis acomana Csy., May,		June:	
August:		Bromegrass, pasture	1
Panic grass	2	Alfalfa, old stand	1
Dropseed	1	Collops sp., June, July:	
Lathrobium sp., April, drop-		Bromegrass, pasture	1
seed	2	Dropseed	1
Philonthus sp., April, dropseed	2	Meloidae:	
Staphylinus cinnamopterus		Epicauta lemiscata (F.), Septem-	
Grav., May, alfalfa old		ber-October, alfalfa new	
stand	2	stand	3
Tachyporus acaudus , Say, May,		Epicauta sp., near cinerea (Forst.),	
little barley	1	June, alfalfa, old stand	1
Tachyporus sp., April:		Epicauta pennsylvanica (Deg.),	
Panic grass	2	September, alfalfa new	
Dropseed	2	stand	1
Alfalfa, old stand	1	Henous confertus (Say.), June-	
Histeridae:		September:	
Hister (Spilodiscus) ulkei Horn,		Bromegrass, pasture	2
March, dropseed	1	Alfalfa, old stand	2
Hister (Spilodiscus) instratus Lec.		Sweetclover	2
May, alfalfa old stand	1	Overgrazed pasture	1
Hister (Spilodiscus) sp. , April,		Anthicidae:	
June:		Anthicus cervinus Laf.,	
Little barley	1	April-May:	
Dropseed	1	Alfalfa, new stand	5
Hister harrisi Kby., March- April:		Bromegrass, pasture	4
Alfalfa, old stand	2	Bluegrass	4
Dropseed	4	Little bluestem	2
Sweetclover	1	Dropseed	2
Hister americanus Payk.,		Sweetclover	2
March, May:		Alfalfa, old stand	2
Dropseed	8	Wheat, pasture	1
Bromegrass, roadside	7	Anthicus sp., April:	
Bluegrass	5	Bromegrass, roadside	1
Native hay I	5	Alfalfa, new stand	1
Little bluestem	3		

Rhipiceridae:

Sandalus niger Knoch, October,
wild rye 1

Elateridae:

Lacon rectangularis (Say),
March-June:
Native hay I 26
Dropseed 20
Sweetclover 17
Panic grass 10
Native hay II 10
Little barley 3
Brome, pasture 2
Little bluestem 2
Bromegrass, roadside 1
Alfalfa, new stand 1
Overgrazed pasture 1

Drasterius amabilis (Lec.),
April, dropseed 2

Aeolus (Drasterius) mellillus
(Say), April-May, July:
Bromegrass, pasture 2
Bluegrass 2
Native hay I 2
Little bluestem 1
Bromegrass, roadside 1
Dropseed 1

Aeolus sp. or Drasterius sp.,
April-May:
Little bluestem 42
Little barley 5
Overgrazed pasture 1
Wheat 1

Melanactes consors Lec., June,
wild rye 1

Melanotus sp., May-June:
Little bluestem 3
Sweetclover 1
Little barley 1
Alfalfa, new stand 1

Erotylidae:

Languria trifasciata Say, May,
sweetclover 1

Lathridiidae:

Melanophthalma sp., April:
Dropseed 2
Alfalfa, new stand 1

Phalacridae:

Stilbus apicalis Melsh.,
April, dropseed 1

Coccinellidae:

Hippodamia convergens Guer.,
April-June:
Alfalfa, old stand 2
Bluegrass 1
Panic grass 1
Bromegrass, pasture 1

Coleomegilla maculata (Deg.),
April, alfalfa new stand .. 1
Undetermined larvae, May,
little bluestem 1

Alleculidae (Cistelidae):

Lobopoda sp., June, native
hay II 1

Tenebrionidae:

Eleodes tricoستاia Say,
April-October:
Little bluestem 17
Overgrazed pasture 10
Native hay I 7
Bromegrass, pasture 2
Little barley 1
Dropseed 1
Sweetclover 1

Eleodes suturalis Say,
April-June:
Native hay II 2
Native hay I 1

Eleodes sp. (larvae), May,
bromegrass pasture 1

Blapstinus pratensis Lec. (near),
April-November:
Overgrazed pasture 49
Native hay I 34
Little barley 6
Bluegrass 3

Dropseed	1	Aphodius granarius L., April,	
Little bluestem	1	bluegrass	1
Native hay II	1	Aphodius femoralis Say,	
Sweetclover	1	April-May, wild rye	3
Alfalfa, new stand	1	Ataenius sp., probably cognatus	
Blapstinus dilatatus Lec.,		Lec., May-June, September:	
April-May, September:		Wheat	16
Bluegrass	2	Alfalfa, new stand	9
Little barley	1	Bluegrass	7
Blapstinus sp., near dilatatus		Alfalfa, old stand	5
Lec., May:		Bromegrass, roadside	2
Bluegrass	2	Wild rye	1
Little barley	2	Overgrazed pasture	1
Blapstinus sp., April-August:		Geotrupes opacus Hald.,	
Overgrazed pasture	66	April, panic grass	2
Native hay I	40	Diplotaxis Sp., April-May,	
Bluegrass	4	July:	
Panic grass	2	Panic grass	3
Native hay II	2	Native hay I	3
Little barley	1	Diazus rudis Lec., July,	
Dropseed	1	panic grass	1
Wild rye	1	Phyllophaga fusca (Froel.),	
Eutochia picea (Melsh.) April,		April, native hay II	1
June, July, September:		Phyllophaga rugosa (Melsh.),	
Alfalfa, old stand	5	May, sweetclover	1
Alfalfa, new stand	2	Phyllophaga sp., probably rubi-	
Eutochia crenata Lec., Septem-		ginosa Lec., June, over-	
ber., alfalfa old stand	2	grazed pasture	1
Melandryidae:		Phyllophaga sp., probably	
Osphya varians (Lec.), May,		corrosa Lec., June, over-	
wild rye	1	grazed pasture	1
Scarabaeidae:		Phyllophaga sp., July-August:	
Canthon pilularis (L.),		Bromegrass, pasture	2
April-July:		Dropseed	1
Overgrazed pasture	9	Phyllophaga tristis (F.), May,	
Little bluestem	7	native hay I	2
Little barley	3	Ligyrodes relictus (Say), May,	
Bromegrass, pasture	3	native hay I	1
Wheat	2	Ligyris gibbosus (Deg.), April-	
Native hay I	2	May:	
Native hay II	2	Panic grass	1
Choridium histeroides (Web.),		Dropseed	1
May, bluegrass	4	Chrysomelidae:	
		Metachroma interruptum (Say),	
		June, panic grass	1

Myochrous denticollis (Say), March, May:		Wild rye	10
Bluegrass	2	Alfalfa, new stand	3
Sweetclover	1	Bromegrass, pasture	1
Phaedon sp., June, bromegrass, pasture	1	Little barley	1
Chrysolina auripennis (Say), September, native hay I	1	LEPIDOPTERA	
Disconycha triangularis (Say), April, June:		Phalaenidae (adults): ¹	
Bromegrass, pasture	1	Chorizagrotis auxiliaris (Grote), May-June:	
Alfalfa, new stand	1	Little bluestem	2
Disonycha xanthomelaena (Dalm.), April-May, October:		Bromegrass, roadside	1
Bluegrass	2	Little barley	1
Bromegrass, roadside	1	Agrotis ypsilon (Rott.), June, wild rye	2
Wild rye	1	Cirphis unipuncta (Haw.), June:	
Little barley	1	Little barley	1
Panic grass	1	Wild rye	1
Curculionidae:		Bromegrass, pasture	1
Epicaerus imbricatus (Say), April-May:		Arctiidae:	
Native hay II	2	Apantesis sp., September, bluegrass	1
Native hay I	1	Geometridae:	
Overgrazed pasture	1	Paleacrita vernata (Peck), March, wild rye	1
Little bluestem	1	Undetermined larvae:	
Wild rye	1	Dropseed	31
Hypera punctata (F.), Septem- ber, November:		Overgrazed pasture	24
Little barley	1	Wild rye	7
Sweetclover	1	Native hay	6
Dorytomus sp., May, panic grass	1	Bluegrass	3
Lixus marginatus Say, May, bluegrass	1	Alfalfa, old stand	3
Lixus musculus Say, May, bromegrass, roadside	1	Alfalfa, new stand	2
Thecesternus affinis Lec., June, bluegrass	1	Bromegrass, pasture	1
Calendra parvula (Gyll.) March, May:		HYMENOPTERA	
Bluegrass	22	Braconidae:	
Bromegrass, roadside	11	Apanteles sp., apparently mili- taris, (Walsh), cocoon clus- ters, June-July:	
		Bromegrass, pasture	85
		Little barley	70
		Bluegrass	55
		Wild rye	55

¹ For list of 24 phalaenid larvae (cutworms and armyworms), see Walkden (5), p. 378.

Bromegrass, roadside	15	Mutillidae:	
Dropseed	11	Pseudomethoca oceola (Blake),	
Panic grass	5	May, sweetclover	1
Native hay I	4	Dasymutilla occidentalis (L.),	
Overgrazed pasture	2	April, dropseed	1
Sweetclover	1	Dasymutilla vesta (Cress.),	
Alfalfa, new stand	1	April, dropseed	1
Scelionidae:		Sphecidae:	
Trimorus sp., April, alfalfa		Chlorion (Priononyx) atratum	
old stand	1	(Lep.) May, bromegrass	
		pasture	1

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CONTRIBUTIONS TO THE KNOWLEDGE OF THE PSYLLIDAE OF MEXICO

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INTRODUCTION

Recorded knowledge of the Mexican forms of this family of homopterous insects is very incomplete. Not only have very few species been described and named but much confusion exists as to the identity of some of these. The great diversity of the forms described plus the abundance of these insects in the portion of the United States which borders Mexico indicate that psyllids probably are very abundant throughout the country. The number of species

and genera new to science which has been encountered in studying the available material fully justifies this belief.

Dr. Alfonso Dampf very kindly sent me, some time ago, approximately 3500 specimens of Psyllidae collected throughout Mexico over a period of years. As most of these insects were collected by Dr. Dampf personally, all specimens cited herein without other indication of collector may be assumed to be his collections. In addition I have had for study a small number of specimens from the United States National Museum. This material furnishes the basis for the following taxonomic treatment. There is no question but that a great many yet undiscovered psyllids occur in Mexico, throughout the entire country. An attempt is made here to furnish a solid foundation for further work by resolving some of the confusion concerning the named forms and providing keys to the entities now known to occur in this area. Only those species actually known to occur in Mexico are treated in the keys and described. However, other known species which almost surely will be found to occur in this fauna are listed under the discussion of each genus. It is hoped that other workers will find this essay helpful. The species recently described by Caldwell are included in the keys wherever possible but are not described or figured as I have not been able to see them.

The author regrets that he is not sufficiently proficient in Spanish to have used that language in writing this work which must necessarily be of greatest interest to entomologists of Spanish speaking countries.

Because of the difficulty of obtaining publication for large and inclusive works it has been thought advisable to publish this paper in parts.

PART I — SUBFAMILY TRIOZINAE

1879 Triozinae Löw, Verh. zool.—bot. Ges. Wien 23: 605, 609.

1886 Triozaria Puton, Cat. Hém. Faune Palea. 93.

1896 Triozidae Edwards, Hemip.—Homop. Br. Is. 227, 251.

Head more or less deflexed, usually small and narrower than thorax. Vertex with medial suture prominent, usually with 2 discal sulci, usually distinctly margined. Genae produced, processes usually conical, sometimes merely swollen, more or less pubescent. Frons covered by genae except small portion bearing median ocellus (perhaps not in *Triozoida*). Eyes hemispherical. Antennae ten-segmented, slender. Thorax strongly arched usually (not in *Leuronota*). Propleurites not equal, suture not extending to middle of pronotum. Forewings membranous, hyaline, typically angulate apically, sometimes narrowly rounded, radius, media and cubitus arising from common base at same point or nearly so (except *Ceropsylla*), no pterostigma, usually 3 radular areas on margin, in cell M_2 , in cell M_1 and cell Cu. Metacoxae with meracanthi present, often with spinose or flattened anterior processes. Metatibiae usually with basal spur or serrate carina, with 1 outer and 2 or 3 inner apical spines (except in *Triozoida* 2 or 3 outer). Proximal segment of metatarsi without spines. Male proctiger usually with caudal lobes.

Type genus: *Trioza* Förster.

As the name indicates one of the prime characters of this subfamily is the trichotomous branching of the basal vein of the forewing. The shape of the forewings, the size and shape of the head and the lack of black spines on the proximal segment of the metatarsi are other distinctive features.

KEY TO THE GENERA OF TRIOZINAE

1. Branching of basal vein strictly trichotomous; vertex with abrupt anterior margin (usually) 2
 Branching of basal vein variable, commonly not trichotomous; vertex rounded down anteriorly, more or less smoothly continuous with genae 6
2. Head wider than thorax **Metatrioza**
 Head narrower than thorax 3
3. Thorax scarcely arched; pronotum long, flat, with a prominent median epiphysis on anterior margin **Leuronota**
 Thorax well arched; pronotum shorter, descending cephalad, without median anterior epiphysis 4
4. Genae produced as usually conical processes 0.5 as long as vertex or longer **Triozia**
 Genae spherically swollen, produced as very small cones or pads or not produced at all 5
5. Genae spherically swollen; female genital segment elongate, dorsal valve nearly straight; male proctiger straight or roundly produced caudad, without elongate caudal lobes **Kuwayama**
 Genae not spherically swollen, with small conical or pad like lobes or not at all produced; female genital segment very short, dorsal valve strongly downcurved; male proctiger with long slender caudal lobes **Paratrioza**
6. Genal processes short, appressed; R + M of forewing with prominent common base **Ceropsylla**
 Genal processes large, not touching; branching of basal vein trichotomous or nearly so 7
7. Vertex bulging; only 1 outer apical spine on metatibiae .. **Myrmecephala**
 Vertex strongly concave, more than 1 outer apical spine on metatibiae **Triozoida**

Genus *Triozia* Förster

1848 *Triozia* Förster, Verh. natur. Ver. preuss, Rhein, 5:67

1915 *Megatrioza* Crawford, Phil. Jour. Sci. 10:253, 264

1926 *Spanioza* Enderlein, Ent. Mitt. 15:400

1926 *Colopelma* Enderlein, Ent. Mitt. 15:400

1926 *Phyllopecta* Ferris, Can. Ent. 58:16

1938 *Phyllopecta* Caldwell, Ohio Biol. Surv., Bull. 34:248

Head usually narrower than thorax, sometimes as wide, deflexed. Vertex much broader than long, usually deeply impressed discally, medial suture prominent, more or less emarginate on anterior margin. Genae produced as processes of varying length and shape, usually conical, more or less divergent, depressed from plane of vertex and usually deflexed. Antennae slender, variable in length from no longer than width of head to several times as long. Eyes hemispherical. Thorax usually strongly arched. Pronotum short, descending cephalad, often depressed below plane of head and mesonotum. Prescutum usually about as long as head, sometimes longer. Forewings membranous, hyaline, usually acute apically, sometimes rounded; radius, media and cubitus arising from basal vein at same point, no pterostigma. Metatibiae often with basal spur or carina, 1 outer and either 2 or 3 inner apical spines. Metatarsi without black clawlike spines. Metacoxae often more or less developed anteriorly. Male proctiger usually with caudal lobes.

Logotype: *Trioza urticae* (Linnaeus)

This genus is very large and widespread in its distribution, being found all over the world. The structure is quite varied. A natural group of species which Crawford has considered worthy of generic rank and designated as *Megatrioza* is of a distinctive habitus and in the area of the Western Pacific, whence most of the species are known, it can be distinguished readily from the more typical *Trioza* species. When the American species are also considered however, there is no single character which is constant throughout the group nor any group of characters which will serve to separate it satisfactorily from *Trioza*. One of the most distinctive characters of *Megatrioza* is the reduction in size of the hind wings which in some species is almost complete and yet the type does not show any reduction in size of the hind wings at all. Similar exceptions occur with respect to all the characters on which the genus was established. After examining several of the Pacific species and the one which occurs in continental America I am convinced that this complex is most properly considered a subgenus.

The only American species of this subgenus, *diospyri*, may be distinguished by the reduced hind wings which are less than half as long as the forewings. It is very characteristic of the group in general appearance and most characters.

Undoubtedly other described species of this genus occur in Mexico. *T. chlora*, *T. lobata*, *T. maura* and *T. nicaraguaensis* are the ones most likely to be found. Some species of the *T. frontalis* complex are also almost surely present.

I have been unable to fit Caldwell's species *rugosata* and *zogoda* into the key.

KEY TO THE SPECIES OF TRIOZA

- | | |
|--|---|
| 1. Metatibiae with 2 inner apical spines | 2 |
| Metatibiae with 3 inner apical spines | 7 |
| 2. Antennae twice as long as width of head | 3 |
| Antennae distinctly less than twice as long as width of head | 4 |

3. Genal processes 0.5 as long as vertex; cubital cell of forewing much larger than medial **magnoliae**
 Genal processes 0.75 as long as vertex; marginal cells equal, small **bifurca**
4. Anal margin of forewing brown **minuta** var. **arizonae**
 Forewings without brown margin 5
5. Rs of forewing long, sinuate **rubra**
 Rs of forewing short, curved to costa 6
6. Pronotum depressed below vertex; cubital cell much larger than medial **russellae**
 Pronotum not depressed below vertex; marginal cells approximately equal **anceps**
7. Antennae twice as long as width of head or longer 8
 Antennae not over 1.66 times as long as width of head (except in **mexicana** sometimes almost twice as long) 18
8. Large species, over 4 mm. to tip of folded wings 9
 Smaller species, less than 4 mm. to tip of folded wings 15
9. Forewings with large brown maculae **inuitata**
 Membrane of forewings immaculate 10
10. Genal processes very short, 0.6 as long as vertex, female genital segment with long styliform apical portion **collaris**
 Genal processes longer, at least 0.8 as long as vertex 11
11. Antennae 2.0 times as long as width of head, female genital segment styliform **apartata**
 Antennae at least 2.33 times as long as width of head, female genital segment, of those known, not styliform 12
12. Membrane of forewings yellow, 5 black spots on margin from base of clavus to apex; antennae 2.33 times as long as width of head **bella**
 Membrane of forewings clear, margin without spots, antennae 2.8 times as long as width of head or more 13
13. Forewings broadly rounded; male forceps shorter than proctiger, in lateral view broad **dampfi**
 Forewings angulate; male forceps as long as proctiger, in lateral view slender 14
14. Apex of male forceps as seen from dorsal view roundly truncate **grandipennis**
 Apex of male forceps as seen from dorsal view produced cephalad as sharp black tooth **grandipennis propinqua**
15. Genal processes as long as vertex **nigriconus**
 Genal processes 0.5 as long as vertex 16
16. Cubital cell of forewing much larger than medial **maritima**
 Marginal cells equal 17
17. Larger species, 3.5-4.5 mm.; female genital segment 0.5 as long as rest of body, abruptly narrowed to styliform portion **collaris**
 Smaller species, 3-3.5 mm.; female genital segment 0.75 as long as rest of body, tapered to styliform portion **proximata**

- | | |
|--|---------------------------|
| 18. Genal processes as long as vertex | 19 |
| Genal processes shorter than vertex | 24 |
| 19. Body unicolorous yellowish green or with thoracic dorsum and an- | |
| tennae black | 19 |
| Body color not as above | 22 |
| 20. Branching of basal vein of forewing trichotomous | 21 |
| Cubitus arising from basal vein separately | <i>cipiphita</i> as |
| 21. Length to tip of forewing 3.75-4.0 mm. | <i>nigriscutum</i> |
| Length to tip of forewing 2.8-3.0 mm. | stroma |
| 22. Cubital cell of forewings larger than medial | <i>longigenae</i> |
| Cubital cell of forewings somewhat smaller than medial | 23 |
| 23. Forewings slender, acutely angled | <i>nigriconus</i> |
| Forewings broad, rounded apically | <i>psyllihabit</i> |
| 24. Antennae at least 1.5 times as long as width of head | 25 |
| Antennae not over 1.25 times as long as width of head | 30 |
| 25. Female genital segment without styliform apical portion; vertex | |
| with distinct anterior margin | 25 |
| Female genital segment with styliform apical portion, vertex without | |
| distinct margin anteriorly, rounded to genae | 23 |
| 26. Medial cell of forewing much larger than cubital; hind wings less | |
| than 0.5 as long as forewings | <i>diospyri</i> |
| Marginal cells of forewing equal; hind wings more than 0.5 as long | |
| as forewings | 27 |
| 27. Pronotum depressed below plane of vertex; genal processes acute, | |
| divergent, Rs usually long, sinuate, marginal cells small | <i>allifrons</i> |
| Pronotum not depressed below plane of vertex; genal processes blunt, | |
| divergent only at apex; Rs short, curved to costa, marginal cells | |
| large | <i>anceps</i> |
| 28. Male forceps notched apically; female genital segment very sharply | |
| constricted to styliform portion | <i>incidata</i> |
| Male forceps entire; female genital segment tapering to styliform | |
| portion | 23 |
| 29. Large, 3.75 mm. | <i>mexicana</i> |
| Smaller, 3 mm. | <i>mexicana minor</i> |
| 30. Genal processes 0.75 as long as vertex | <i>hidalgoensis</i> |
| Genal processes not over 0.50 as long as vertex | 31 |
| 31. Anterior margin of vertex smoothly rounded | <i>mexicana curtigena</i> |
| Anterior margin of vertex deeply notched | <i>thoracia</i> |

***Trioza magnoliae* (Ashmead)**

Figs. 1, 2, 3.

1881 *Psylla magnoliae* Ashmead, Can. Ent. 13: 224

1885 *Trioza magnoliae* Riley, Proc. Biol. Soc. Wash. 2:70

1911 *Allotrioza magnoliae* Crawford, Pcm. Coll. Jour. Ent. 3:444, 445

1914 *Trioza magnoliae* Crawford, U. S. Nat. Mus., Bull. 85:96

1919 *Trioza magnoliae* Barber, Proc. Ent. Soc. Wash. 21:59

Length to tip of folded wings 3.5 to 4.5 mm.

Color: General color green to light brown. Sometimes with longitudinal brown stripes on thoracic dorsum. Tips of antennae dark. Eyes reddish. Wings hyaline.

Structure: Head large, as broad as thorax, scarcely deflexed. Vertex large, flat except for discal impressions, medial suture prominent, strongly excavate posteriorly. Genal processes short, blunt, divergent, about 0.5 as long as vertex. Antennae twice as long as width of head. Vertex and thoracic dorsum with more or less short pubescence, most evident near eyes. Thorax moderately arched, long. Pronotum not depressed below plane of vertex, caudal margin upcurved, carinate. Prescutum distinctly longer than wide, anterior angle very sharp and abrupt. Forewings large, straight, sharply angulate, almost 3 times as long as wide; Rs long, somewhat sinuate, cubital cell much larger than medial. Hind wings 0.6 as long as forewings. Metatibiae with large, serrate basal carina, 1 outer and 2 inner apical spines. Metacoxae moderately produced anteriorly.

Male proctiger small, arcuate on caudal margin from near apex. Forceps slightly longer than proctiger; in lateral view broad, somewhat pyriform, anterior margin strongly curved caudad, apex blunt, black, in line with posterior margin; in caudal view stout, almost straight, slightly arcuate, apices touching. Female genital segment large, 0.66 as long as rest of abdomen, valves almost equal in length, acute.

The above description is from specimens taken in Florida. The only specimen at hand from Mexico is a male from San Pedro Yaneri, Oaxaca, collected at light, June 19, 1935 by Francisco Reyes. This specimen differs from the above description in several respects. It is larger 5.5 mm.; the genal processes are longer (they are somewhat malformed); the forceps are shorter than the proctiger. I believe this specimen is the same species as the differences while definite are not great if the distance separating the localities is considered. The nymphs form galls on the leaves of the host, which is possibly *Persea* spp. instead of *Magnoliae* as it seems that Ashmead may have been confused as to the identity of the tree from which he took the originally described specimen (see Barber, loc. cit.)

Host: *Magnoliae* sp. (doubtful)

Type, no. 14819 United States National Museum

***Trioza bifurca* n. sp.**

Figs. 4, 5, 6.

Length to tip of folded wings 3.50 mm.

Color: Thorax and head more or less fuscous. Antennae whitish except tip black. Abdomen green. Male darker than female.

Structure: Head large, almost as wide as thorax. Vertex deeply concave discally, sharply margined posteriorly and anteriorly, median suture prominent. Genal processes slender, acute, not touching, 0.75 as long as vertex.

Additional small rounded processes beneath eyes. Antennae twice as long as width of head. Thorax moderately arched. Pronotum depressed much below vertex. Prothoracic episterna strongly produced and extending forward behind eyes. Forewings over 2.5 times as long as wide, straight, bluntly angled; Rs long, somewhat sinuate, marginal cells small, equal. Hind wings large, 0.75 as long as forewings. Metatibiae with serrate basal carina, 1 outer and 2 inner apical spines. Metacoxae strongly produced anteriorly, apices free, caudal metacoxal spurs long, cylindrical, truncate.

Male proctiger short, with extremely long, slender, terete caudal lobes, enclosing forceps. Forceps short, stout, in caudal view swollen, bowed, narrowed toward apex, apically enlarged and divided into two divergent, pointed lobes. Female genital segment much shorter than rest of abdomen; dorsal valve swollen, overhanging, pointed; ventral valve shorter, tapered to acute apex.

Holotype, male **allotype**, female, one male and one female paratype swept from low vegetation above timberline on the summit of Telapon Mountain (app. 4000 meters), Tlaloc-Ixtachihuatl range in the Valley of Mexico July 25, 1937. One additional male paratype swept from grass in an open pine forest between 3000 and 3400 meters on Telapon Mountain, same date.

Host: Unknown

The name refers to the forked male forceps.

Holotype, allotype and paratype in author's collection, paratypes in Dampf's collection.

***Trioza minuta* var. *arizonae* Aulman**

Figs. 7, 8, 9.

1910 *Trioza marginata* Crawford, Pom. Coll. Jour. Ent. 2: 232, 356.

[non] *Trioza marginata* Löw, Verh. zool. -bot. Ges. Wien 32: 242, 1882.

1912 *Trioza arizonae* Aulmann, Ent. Rund., heft 22.

1941 *Trioza arizonae* Caldwell, Ohio Jour. Sci. 41:422

1943 *Trioza minuta* var. *arizonae* Tuthill, Ia. St. Coll. Jour. Sci. 17:563

1944 *Trioza arizonae* Caldwell, Ohio Jour. Sci. 44:62

Length to tip of folded wings 3 mm.

Color: Head orange with black markings to entirely black. Genal processes black. Thorax orange, more or less infuscated. Abdomen white ventrad, brown dorsad. Forewings narrowly embrowned on anal margin from base to apex.

Structure: Head narrower than thorax. Vertex plane with shallow discal impressions, margins abrupt, protruding over anterior ocellus. Genal processes 0.6 as long as vertex, conical. Antennae about 1.6 times as long as width of head. Thorax strongly arched. Pronotum depressed below vertex. Forewings slender, angulate, 2.7 times as long as wide; Rs long, slightly sinuate, marginal cells small, cubital flattened. Hind wings 0.75 as long as forewings. Metatibiae with small basal spur or serrate carina, 1 outer and 2 inner apical spines. Metacoxae produced anteriorly.

Male proctiger shorter than forceps, with short, blunt, caudal lobes. Forceps in lateral view slender, bent cephalad apically, tapering to acute tip; in caudal view broad basally, slightly arched to acute apices, moderately pubescent, dorsal margin brown. Female genital segment shorter than rest of abdomen; dorsal valve downcurved, black tipped, acute; ventral valve shorter than dorsal, thin and upturned apically, in ventral view produced medially as rounded tooth.

Specimens of this *Salix* inhabiting species are at hand bearing the following data: Xochimilco, D. F., swept from willows, *Urtica*, etc., September 30, 1923 and June 13, 1933; Chapingo, Mexico, July 11, 1924; Nainari, near Cajeme, Sonora, swept from willow leaves, March 17, 1927; Hacienda Fresno, near Torreon, Coahuila, June 11, 1931; swept from weeds on the sandy shore of the Grijalva River near Tuxtla Gutierrez, Chiapas, May 27, 1926; at the railway station Papalopam, Vera Cruz, swept from shrubs and weeds on the banks of the river, December 21, 1937; San Jacinto, D. F., taken at light, April 28, May 16 and 26, June 4 and 29, 1932. It has been reported from Tamazunchale, San Luis Potosi, Orizaba, Veracruz and Zamora, Michoacan by Caldwell.

The typical subspecies is not known to occur in Mexico but probably does, at least in the northern portion.

Host: *Salix*

Type no. 18087, United States National Museum

Trioza rubra Tuthill

Figs. 10, 11, 12.

1939 *Trioza rubra* Tuthill, Ia. St. Coll. Jour. Sci. 13:185

1944 *Trioza albanigra* Caldwell, Ohio Jour. Sci. 44:62

Length to tip of folded wings 3.5 mm.

Color: General color of male from light reddish brown to chocolate brown. Antennae whitish except three apical segments black. Mesoscutum with two prominent longitudinal chocolate stripes. Female lighter.

Structure: Head large, narrower than thorax. Vertex slightly concave posteriorly, all margins abrupt, anterior margin sharply excavate medially, discal impressions broad, medial suture prominent. Genae and anterior ocellus beneath overhanging vertex. Genal processes short, slightly over 0.5 as long as vertex, divergent, blunt. Antennae 1.7 times as long as width of head. Thorax moderately arched. Pronotum short, strongly depressed, below plane of vertex. Proepisternum strongly produced and extending forward. Mesoscutum flat dorsally. Forewings 2.5 times as long as wide, broadly angulate; Rs long, somewhat sinuate, marginal cells rather small, equal. Hind wings 0.7 as long as forewings. Metatibiae with serrate basal carina, 1 outer and 2 inner apical spines. Metacoxae strongly produced anteriorly as blunt lobe.

Male genitalia small. Proctiger short, with large caudal lobes as long as axial portion. Forceps longer than proctiger; in lateral view slender,

slightly bent cephalad, tapering to very slender, sharp apices, anterior margin sinuate; in caudal view swollen basally, lateral margin straight to acute tip, mesal margin with triangular tooth midway. Female genital segment much shorter than rest of abdomen; dorsal valve rounded down to blunt apex; ventral valve shorter than dorsal, sharp apically.

Five males and three females (one pair on slide) swept from low vegetation, chiefly grass, at 3600 meters on Cerro de Hongos near Cerro San Miguel, southwest of Mexico City, April 5, 1925. One additional pair swept from grass on summit of Mount Ajusco, treeless, south of Mexico City, at 4000 meters, May 10, 1925.

This species was described from Colorado, United States and is known from New Mexico, Arizona and Oregon. The specimens at hand show minor differences from the more northern specimens.

Host: Unknown

Type in author's collection.

The specimens which Caldwell described as *T. albanigra* are apparently this species which exhibits a considerable range of color as well as locality. I presume *albanigra* var. *aurodorsa* to be a color variant as Caldwell indicates. His specimens were taken on Popocatepetl and at Rio Frio, Puebla.

Trioza russellae n. sp.

Figs. 13, 14, 15.

Length to tip of folded wings 3 mm.

Color: General color chocolate brown. Legs, antennae, genal processes, pleurites and venter more or less yellow.

Structure: Entire body pubescent. Head large, almost as wide as thorax. Eyes unusually large. Vertex narrow, with longitudinal sulcus each side of medial suture, produced anteriorly each side of medial suture, margin overhanging antennal sockets, posterior margin deeply concave. Genae produced as small, blunt lobes, 0.3 as long as vertex. Antennae slender, short, 1.4 times as long as width of head. Thorax strongly arched. Pronotum very short, strongly depressed below plane of vertex. Thoracic dorsum finely rugose. Forewings 3 times as long as wide, somewhat constricted opposite furcation of basal vein, origin of R, M and Cu variable, typically trichotomous, occasionally R or Cu arising separately; basal vein long, Rs short, curved to costa, medial cell apical, small, cubital much larger. Hind wings large, 0.63 as long as forewings, covered with minute setae. Metatibiae with basal spur, 1 outer and 2 inner apical spines. Metacoxae slightly produced anteriorly.

Male genitalia small. Proctiger straight, short, rounded caudally. Forceps shorter than proctiger; in lateral view broad, straight, tapered apically to sharp apex, in caudal view broad, strongly arched, apically tapered to sharply upturned, contiguous apices. Female genital segment short, valves about equal, black tipped, sharp.

The furcation of the basal vein is quite variable in this species. A majority of the specimens at hand have the three veins arising together but several

show a distinct radio-medial petiole while one has a short medio-cubital petiole. In this and other features such as the length of the basal vein, the shape of the forewings, the genal processes, this form shows affinities to *Ceropsylla*.

Holotype, male, **allotype**, female, 3 male and 1 female paratypes, Finca "La Fortuna", Chiapas, October 30, 1938, collected at light by Dr. R. Nettel. Other paratypes are from Finca "La Fortuna," Chiapas, taken by Dr. Nettel on the following dates in 1938, October 16 (1 male), 17 (1 male), 29 (2 females) and from Finca Esperanza, Chiapas, collected by Dr. Nettel on June 10 (2 males and 2 females), June 16 (1 male), November 2 (1 male), November 4 (1 male), 1938, all taken at light.

Host: Unknown

Holotype, **allotype** and paratypes in author's collection, paratypes in Dampf's collection.

This species is named in honor of Louise M. Russell of the United States National Museum who has greatly assisted the author by comparing specimens and in other ways.

***Trioza anceps* n. sp.**

Figs. 16, 17.

1914 *Trioza koebeleri* Crawford, U. S. Nat. Mus., Bull. 85:97

[non] *Trioza koebeleri* Kirkaldy, Can. Ent. 37:290, 1905

Length to tip of folded wings 3.75 to 4 mm.

Color: General color testaceous. Dorsum darker. Abdomen brown. (Probably greenish when alive).

Structure: Head narrower than thorax. Vertex plane, raised above eyes, margins rounded, discal impressions round, shallow, medial suture prominent. Genal processes short, stout, divergent apically, 0.5 as long as vertex, parallel to plane of vertex. Antennae almost 1.5 times as long as width of head. Eyes small, hemispherical. Thorax strongly arched. Pronotum moderately long, not depressed below vertex. Forewings nearly 3 times as long as wide, bluntly angular; Rs short, curved to costal margin, marginal cells equal. Hind wings 0.7 as long as forewings. Metatibiae with small serrate basal carina, 1 outer and either 2 or 3 inner apical spines. Metacoxae but slightly produced anteriorly.

Female genital segment 0.66 as long as rest of abdomen; dorsal valve straight, acute; ventral valve nearly as long as dorsal, acute, somewhat swollen basally.

Holotype, female, no. 56931 United States National Museum and 4 female paratypes bearing the data "Morelos, Koebele", are at hand. I think it probable that these are the specimens Koebele found forming galls on aguacate, the data for which was erroneously assigned to specimens of *diospyri* by Kirkaldy. These specimens have been compared with one of those from Cuernavaca, taken on aguacate, which Crawford assigned to the name *koebeleri*. The latter is identical with the series at hand.

Only one complete antenna remains on any of the specimens. The number

of inner apical spines on the metatibiae, usually quite constant, is variable in these specimens. The holotype and one other specimen have 2 on one tibia and 3 on the other. A third specimen has 2 on each tibia and the tibiae of the other two specimens are covered with glue. The name *anceps* is given because of this irregularity.

Host: *Persea americana*, avocado or aguacate.

***Trioza inusitata* n. sp.**

Figs. 18, 19.

Length to tip of folded wings 5 mm.

Color: General color yellow with dark brown markings as follows: broad vitta each side of thorax from eye back onto abdomen, abdominal tergites, margin of abdominal sternites, most of thoracic venter and femora. Forewings hyaline except dusky basally, dark brown vittae as shown in figure.

Structure: Body evenly clothed with short sparse pubescence. Head narrower than thorax. Vertex angularly emarginate posteriorly, with deep, sulcate discal impressions, rounded down anteriorly to genal processes. Genal processes slender, separated, not divergent, nearly as long as vertex. Antennae 2.5 times as long as width of head. Thorax rather flat. Pronotum long, with blunt, median, anterior epiphysis. Forewings acutely angled, 3 times as long as wide; Rs moderately long, rather abruptly turned to costa, M somewhat sinuate, marginal cells large. Hind wings large, 0.66 as long as forewings. Metatibiae with serrate basal carina, 1 outer and 3 inner apical spines. Metacoxae moderately produced anteriorly.

Female genital segment 0.5 as long as rest of abdomen; dorsal valve swollen dorsally, rounded down to apex, split apically to allow ovipositor to protrude; ventral valve of almost equal length, sharp.

Holotype, female, Cordoba, Mexico, December 23, 1907, Fredrik Knab. This unique specimen is in the United States Museum, Catalogue Number 56962.

Host: Unknown

This species shows affinities to the species of *Leuronota*.

***Trioza bella* n. sp.**

Figs. 20, 21.

Length to tip of folded wings 5 mm.

Color: General color stramineous. Dorsum and vertex orange, black margins on pronotum and prescutum, prescutum and scutum with slight median line, metathorax and abdomen with wide black dorsal band. Anal margin of forewing more or less embrowned, definite spots midway and at apex of clavus, midway of each marginal cell and between them, membrane yellowish.

Structure: Pubescent. Thoracic dorsum and vertex with numerous very long setae. Head almost as wide as thorax, strongly deflexed. Vertex plane, very shallow discal impressions, median suture very prominent, produced anteriorly at each side at base of antennae. Genal processes large, slender, acute, not at all contiguous, slightly curved forward, 0.8 as long as vertex. Antennae slender, 2.33 times as long as width of head. Thorax strongly

arched. Pronotum below plane of vertex. Prescutum almost as long as wide. Forewings very large, broad, 2.33 times as long as wide, blunt apically; Rs very long, somewhat sinuate, marginal cells equal. Hind wings large, 0.66 as long as forewings. Metatibiae with slight basal tubercle, 1 outer and 3 inner apical spines. Metacoxae not produced anteriorly.

Male proctiger short, stout, roundly produced caudad. Forceps almost as long as proctiger; in lateral view stout, straight, slightly produced on caudal margin near apex; in caudal view stout, nearly straight, produced mesad at apex as truncate black tooth; in dorsal view apices broadly truncate, black.

Holotype, male, collected in dense and humid virgin forest at 2750 meters on Zontehuitz Mountain, north of San Cristobal las Casas, Chiapas, June 20, 1926, in Dampf's collection.

Host: Unknown

***Trioza dampfi* n. sp.**

Figs. 22, 23, 24.

Length to tip of folded wings 4.50-5.0 mm. Females slightly larger than males.

Color: Females uniformly greenish yellow. Males darker, stramineous with brown on abdomen, venter of thorax and more or less on lateral margins of thoracic dorsum. Wings hyaline.

Structure: Body pubescent, including thoracic dorsum. Head wider than mesoscutum, not strongly deflexed. Vertex with sharp transverse sulcus connecting large, deep discal foveae; rounded down anteriorly but sharply divided from genae. Genal processes large, slender, acute, not touching, 0.75 as long as vertex, nearly parallel to plane of vertex. Antennae 2.8 times as long as width of head. Thorax strongly arched. Pronotum depressed below vertex. Forewings large, very broad, 2.25 times as long as wide, broadly rounded apically; Rs long, slightly sinuate, medial cell somewhat larger than cubital. Hind wings almost 0.66 as long as forewings. Metatibiae without basal armature. 1 outer and 3 inner apical spines. Metacoxae not produced anteriorly.

Male genitalia large. Proctiger roundly produced caudad, below small apical epiphysis. Forceps shorter than proctiger; in lateral view stout, evenly curved cephalad to truncate apices; in caudal view stout, nearly straight, medially produced at apex at blunt black tooth. Female genital segment as long as rest of abdomen, broad basally, tapered; dorsal valve somewhat attenuate in apical third, sharp; ventral valve nearly as long as dorsal, sharply upturned midway, apex acute.

Holotype, male, **allotype**, female, and 27 male and female paratypes swept from **Scenecio** sp. in a mountain forest near Mexico City, Desierto de los Leones, at 3000 meters, January 8, 1933.

Additional specimens, mostly mutilated, are at hand with the following data: 5 males and 2 females swept from bush (*Senecio*, *Salvia*, etc.) in Desierto de los Leones, wood covered mountains 20 km. southwest of Mexico City, mostly **Pinus** and **Abies** with luxuriant undergrowth, at 2800 meters, Septem-

ber 23, 1923 (1 male and 1 female mounted on slide); 2 males and 1 female same data, December 9, 1923; 3 males and 2 females swept from shrubs and low vegetation in the barranca del Rio Tepazulco at 3000 meters, Desierto de los Leones, July 20, 1924; 2 males and 2 females, same data, January 25, 1925.

Host: Unknown

Holotype, allotype and paratypes in author's collection, paratypes and others in Dampf's collection.

It is with pleasure that I name this species in honor of Dr. Alfonso Dampf, the collector.

***Trioza grandipennis* n. sp.**

Figs. 25, 26, 27.

Length to tip of folded wing 5 mm.

Color: Stramineous to green, antennae darker, apical portion of each segment black. Wings hyaline.

Structure: Body with long sparse pubescence. Head small, narrower than thorax. Vertex deeply emarginate anteriorly and posteriorly, very deep, sulcate discal impressions. Genal processes slightly longer than vertex, divergent, acute, parallel to plane of vertex. Antennae 3 times as long as width of head. Thorax narrow, strongly arched. Pronotum long, more or less produced as median epiphysis, scarcely deflexed anteriorly, below plane of vertex. Forewings very large, angled at apex, 2.66 times as long as wide; Rs long, slightly sinuate, marginal cells equal. Hind wings over 0.5 as long as forewings. Metatibiae with small serrate basal carina, 1 outer and 3 inner apical spines. Metacoxae not produced anteriorly.

Male genitalia large. Proctiger strongly produced caudad below slender apical epiphysis. Forceps as long as proctiger; in lateral view slender, straight to apical third then enlarged and turned caudad to blunt apex; in caudal view slender, nearly straight, apically turned in, sharp, black tipped; in dorsal view tips black, truncate. Female genital segment large, nearly as long as rest of abdomen; dorsal valve attenuate in apical third, to blunt tip; ventral valve nearly equalling dorsal, upturned, sharp.

Holotype, male, **allotype**, female swept from dense bush in pine and oak forest on the summit of Cerro Vista Hermosa, 2400 meters, in the Moshbiquil range near San Cristobal Las Casas, Chiapas, July 17, 1926. Paratypes as follows: 1 male and 1 female, swept from shrubs growing between rocks in mixed forest on Cerro Ecatepec, 2400 meters, near San Cristobal Las Casas, June 24, 1926; 1 male and 1 female swept from shrubs and weeds in mixed forest on the road from San Cristobal Las Casas to Huixtan at 2200 meters, July 7, 1926; 1 female swept in an oak forest, over the ground covered with fallen leaves near Hueytepec mountain, 2100 meters, San Cristobal Las Casas, July 23, 1926; 1 additional male, mounted on a slide, which seems to be this species is from Desierto de los Leones, December 9, 1923.

Host: Unknown

Holotype, allotype and paratypes in author's collection, paratypes in Dampf's collection.

***Trioza grandipennis propinqua* n. subsp.**

Length to tip of folded wings 4.5 mm.

Color: Stramineous except apex of antennal segments black, abdomen green.

Structure: Similar to typical subspecies except antennae somewhat less than 3 times as long as width of head. Genal processes shorter. Cubital cell of forewing more slender, Rs straighter.

Male proctiger large, produced caudad from near base almost to apex, a small apical epiphysis. Forceps as long as proctiger; in lateral view slender, curved cephalad then caudad to blunt black tips in caudal view stout, straight margined mesad with short stout setae, incurved apically, touching, apices black, sharp; in dorsal view apices obliquely truncate, produced anteriorly as sharp black tooth. Female genitalia similar to typical subspecies.

Holotype, male, **allotype**, female, 2 male paratypes swept from grass, low vegetation and *Alnus* bushes in open pine forest, Lagunas de Zempoala, Morelos, appr. 2800 meters, September 2, 1937.

This form in addition to the distinctive male genitalia differs from the typical subspecies in numerous minor structures. The differences are mostly of degree. It is hoped that more extensive future collecting may serve to clarify its relationship.

Holotype and allotype in author's collection, paratypes in Dampf's collection.

***Trioza nigriconus* n. sp.**

Figs. 28, 29.

Length to tip of folded wings 3 mm.

Color: General color yellow, darker dorsad. Legs white except tibiae and tarsi of pro and mesothorax black. Genal processes and occiput black, rest of head lighter, vertex brown. Wings hyaline.

Structure: Head as wide as thorax. Vertex smooth, concave posteriorly, rounded down anteriorly, very strongly raised laterally above level of eyes. Genal processes large, conical, touching, acute, as long as vertex. (Antennae lacking in specimens at hand). Thorax small, very strongly arched. Pronotum short, nearly vertical. Forewings slender, acutely angled, 3 times as long as wide; Rs short, straight, R and M with short common petiole, medial cell larger than cubital. Hind wings slender, over 0.5 as long as forewings. Metatibiae with small basal spur, 1 outer and 3 inner apical spines. Metacoxae not produced anteriorly.

Male genitalia small. Proctiger slender, rounded on caudal margin. Forceps shorter than proctiger; in lateral view enlarged from base to black roundly truncate apex; in caudal view slender, scarcely bowed to blunt black apices; in dorsal view tips black, curved, serrate on mesal margin.

Holotype, male, one male paratype, swept from shrubs near Finca Vergel, slope to the Huixtla Valley, Chiapas, June 5, 1935.

Host: Unknown

Holotype in author's collection, paratype in Dampf's collection.
The name refers to the prominent black conical genal processes.

***Trioza maritima* n. sp.**

Figs. 30, 31, 32.

Length to tip of folded wings 3.5 mm.

Color: General color stramineous with some more yellow markings dorsally. Abdomen of female darker.

Structure: Head fully as wide as thorax. Vertex broad, very strongly depressed discally, abruptly emarginate anteriorly, produced strongly each side of median ocellus, latter visible from above. Genal processes small, conical, 0.5 as long as vertex, divergent. Eyes somewhat flattened posteriorly. Antennae 2.66 times as long as width of head. Thorax quite flat. Pronotum large, not depressed below vertex. Mesothoracic prescutum as long as wide. Forewings large, slightly over 2.5 times as long as wide, angulate apically; Rs long, nearly straight, marginal cells large, cubital much larger than medial, base of Cu very short. Hind wings 0.66 as long as forewings. Metatibiae with basal spur, 1 outer and 3 inner apical spines. Metacoxae not produced anteriorly.

Male proctiger in lateral view slender, parallel sided. Forceps less than 0.5 as long as proctiger; in lateral view very broad, slightly narrowed apically to truncate apex; in caudal view stout, nearly straight, sharply turned in apically, a small sharp black tooth mesad, before apex. Female genital segment large, stout, almost as long as rest of abdomen; dorsal valve large, swollen, extending far down on sides, apex with long slit through which ovipositor projects; ventral valve nearly as long as dorsal, acute, black tipped, serrate apically.

Holotype, male swept from *Salsola kali* and low mangrove bushes on the sea shore at Ciudad del Carmen, Campeche, January 15, 1939. **Allotype** female taken on light at Ciudad del Carmen, Campeche in the suburb Guanal, January 16, 1939.

This very distinctive species shows marked affinities to the genus *Meta-trioza* which was established for a species taken in the state of Arizona, United States.

Host: Unknown

Holotype in author's collection, allotype in Dampf's collection.

***Trioza collaris* Crawford**

Figs. 33, 34, 35.

1910 *Trioza collaris* Crawford, Pom. Coll. Jour. Ent. 2:229, 347

1910 *Trioza longistylus* Crawford, Pom. Coll. Jour. Ent. 2:233

1941 *Trioza longistylus* Caldwell, Ohio Jour. Sci. 41:422

Length to tip of folded wings 3.5 to 4.5 mm.

Color: General color green to yellowish green, occasionally with some darker markings on dorsum of thorax. Tip of antennae, styliform portion of female genitalia and apex of male forceps, dark.

Structure: Head large, only slightly narrower than thorax. Vertex scarcely plane, discal impressions prominent. Genal processes short, not over 0.5 as long as vertex, appressed, blunt to acute. Antennae twice as long as width of head. Thorax large, flat. Pronotum long, strongly descending cephalad, not depressed below vertex. Forewings large, angular to somewhat rounded apically, about 2.5 times as long as wide; Rs long, somewhat sinuate, marginal cells about equal. Hind wings 0.66 as long as forewings. Metatibiae with basal tubercle bearing 2 small spines, 1 outer and 3 inner apical spines. Metacoxae scarcely produced anteriorly.

Male proctiger roundly produced on caudal margin. Forceps about as long as proctiger, slender, bent cephalad, slightly bowed, apices sharp, black. Female genital segment large, about twice as long as rest of abdomen, about 0.5 as long as remainder of body, consisting of large basal portion and styliform projection, latter about as long as base, black; basal portion produced ventrad just before constriction.

Apparently this is one of the most abundant species of psyllids in Mexico. It is represented in the material at hand by very many specimens (several hundred) from widely scattered localities. The data are given below. It is quite closely related to *Triozia proximata*. The females of the two species are quite distinct but it is impossible to separate the males with certainty. I do not believe that the specimen which Crawford described as *longistylus* represents a distinct species.

The greatest numbers of specimens are from San Jacinto, D. F., Lomas de Chapultepec, D. F., and near San Cristobal Las Casas, Chiapas. The largest single collections are from the latter locality. The San Jacinto specimens were taken at light on April 28 and 29, May 2, 4, 8, 16, 24 and 26, June 4, 7, and 15, July 1, 26 and 28, September 5, 7, 20 and 30, 1932, and on March 21, May 26, and 29, June 5, 6, and 13, July 1, 2 and 26 and September 25, 1933. The specimens taken at Lomas de Chapultepec were either taken at a light or swept from lawns or other low vegetation on April 17 and July 25, 1939, May 29, 1940, May 31, June 1 and 29, July 27, September 25, and November 20, 1941; April 13, May 7 and 16, 1942.

Continued next issue

NOTE

Change of Name in Diptera (Tachinidae). Mr. Owen Bryant, Steamboat Springs, Colorado, has informed me that *Orthosia* Reinhard (Jr. Kans. Ent. Soc., 17:60, 1944) is preoccupied by Ochsenheimer (Schmett. Eur., IV, 79, 1816). I therefore propose the name *Orthosimyia* in place of *Orthosia* cited above.—H. J. Reinhard.

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